University of Chester

*Faculty of Applied Science*
*Clinical Sciences*

*Master of Science*
*In*
*Cardiovascular Rehabilitation*

# Assessing the variance in anxiety, depression, lifestyle and readmission outcomes between patients treated for acute ST elevation myocardial infarction with Primary Percutaneous Coronary Intervention versus Thrombolysis.

**Dissertation submitted in accordance with University of Chester requirements**
**For the Degree of Master of Science**

*Fiona Barnard*

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# Declaration

**Declaration of Original Work**:

I hereby declare this work is original. No content has had previous submission to support degree qualifications, or other course.

Signed: .....

Fiona Barnard

# Abstract

**Background:** Anxiety levels are known to be elevated following a Myocardial Infarction (MI). If untreated, results can lead to depression and an increase in recurrent events (Frasure-Smith, Lesperance, Talajic, 1994). Patients undergoing thrombolysis to treat their MI remain in hospital for approximately 5 days. The introduction of Primary Percutaneous Coronary Intervention (PPCI) has seen the Bristol Royal Infirmary (BRI) reduce PPCI patients' length of stay to an average of 2.7 days (Oriolo & Tagney, 2011). There is little evidence to indentify if this results in positive or negative effects on patient anxiety and depression. Length of in-patient stay affects patient's ability to absorb information (Astin et al 2008a). A short stay in hospital may affect anxiety due to less time spent on providing information and support to patients and their families. It is possible prolonged recovery or increased readmissions could be due to anxiety issues. The study aim is to investigate if anxiety and depression levels in PPCI patients from South Bristol result in different outcomes compared to Thrombolysis patients.

**Study design:** A retrospective study of patients admitted to BRI with a first time STEMI treated with either Thrombolysis or PPCI from April 2004 to March 2010. The study will provide insight into patients' motivation to lifestyle changes. Overall, the study will identify improvement or deterioration in patient recovery from an MI with the introduction of PPCI.

**Method:** Myocardial Ischemia National Audit Project (MINAP) provided patient identification data. MINAP data was matched with the BRI Cardiac Rehabilitation Patient Audit tracking System (CRPATS). Hospital anxiety and depression scores (HADS) were used, to measure emotional outcomes. Readmission data was collected from PATS, hospital and patient medical records. Cardiac rehabilitation attendance

and lifestyle outcomes were obtained from CRPATS data. Patient information remains anonymous for the purpose of this study. Application of the Statistical Package for the Social Sciences (SPSS) calculated statistical analysis.

**Findings:** Unplanned re-admissions occurred sooner for PPCI patients at the BRI (p = .034) as did cardiac related re-admissions (p = .049). A significant link exists with PPCI increased number of cardiac related re-admissions and increased phase II depression scores (P = .024). PPCI patients had shorter hospital admissions following their initial event (P = .005). PPCI deaths occurred earlier than Thrmobolysis (P = .001) Shorter hospital admissions were linked to increased phase II depression (P = .041), phase III anxiety scores (P = .031) anxiety levels (P = .009) in thrombolysis patients. PPCI patients anxiety improved at phase III compared with Thrombolysis (p = .031). Thrombolysis depression levels and scores demonstrate significant reductions between phases (P = .037). Female anxiety scores were higher than male at phase III (P = .019). Cholesterol and Smoking improved between phase II and III. Activity decreased in both treatments between phases. Longer admissions were linked to decreased diastolic blood pressure, weight and alcohol. Females have poorer outcomes in terms of risk factor management between phase II and III cardiac rehabilitation than males.

**Conclusion:** The introduction of PPCI has not been detrimental to South Bristol patients outcomes. More prospective studies are necessary to identify if links with length of stay, readmission time and premature deaths are valid amongst PPCI patients. Further investigation is necessary to find reasons behind reduced activity and poorer outcomes for females at phase III. (544 words)

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# Abbreviations

| Abbreviation | Title in full |
|---|---|
| BACR | British Association of Cardiac Rehabilitation |
| BHI | Bristol Heart Institute |
| BMI | Body Mass Index |
| BP | Blood Pressure |
| BRI | Bristol Royal Infirmary |
| CABG | Coronary Artery Bypass Grafts |
| CAD | Coronary Artery Disease |
| CHD | Coronary Heart Disease |
| CRPATS | Cardiac Rehabilitation Patient Audit Tracking System |
| CVD | Cardiovascular disease |
| DBP | Diastolic Blood Pressure |
| ECG | Electrocardiograph |
| ESC | European Society of Cardiology |
| GP | General Practitioner |
| GWAS | Gloucester, Wiltshire, Avon and Somerset network |
| HADS | Hospital Anxiety and Depression Score |
| HDL | High Density Lipoproteins |
| IQR | Interquartile Range |
| LDL | Low Density Lipoproteins |
| LV | Left Ventricle |
| LPSS | Low Perceived Social Support |

| | |
|---|---|
| MI | Myocardial Infarction |
| NAS | Normative Ageing Study |
| NICE | National Institute for Clinical Excellence |
| NO | Nitrous Oxide |
| NSF | National Service Framework |
| PCI | Percutaneous Coronary Intervention |
| PHT | Pre Hospital Thrombolysis |
| PPCI | Primary Percutaneous Coronary Intervention |
| PTSD | Post Traumatic Stress Disorder |
| SBP | Systolic Blood Pressure |
| SD | Standard Deviation |
| SIGN | Scottish Intercollegiate Guideline Network |
| SPSS | Statistical Package for the Social Sciences |
| STEMI | ST Elevation Myocardial Infarction |
| UK | United Kingdom |

# 1. Introduction

## 1.1 General Overview

Cardiovascular Disease is one of the main causes of premature death in the United Kingdom (UK) accounting for almost 191,000 deaths each year or one in every three deaths, of which 46% are due to Coronary Heart Disease (CHD) (British Heart Foundation BHF, 2010). Treatments for prevention of cardiac deaths have developed rapidly over the last forty years. Revascularisation treatments have become commonplace for conditions such as angina and Myocardial Infarction (MI) with Coronary Artery Bypass Graft (CABG) surgery becoming routine in the mid 1970's (British Heart Foundation Health promotion Research Group, 2010). Nearly 23,000 CABG operations were performed in the UK by the year 2008. Andreas Gruntzig pioneered percutaneous coronary intervention (PCI) treatments for coronary vessel disease in 1979 with successful reduction of stenosis in 32 out of 50 patients (Grüntzig, Senning, & Siegenthaler, 1979a). Today PCI is a routine treatment for patients with CHD. By 2008 PCI interventions exceeded 80,000 in the UK (British Heart Foundation Health promotion Research Group, 2010).

Further development of PCI treatment involved replacing thrombolysis and rescue PCI for ST elevation myocardial infarction (STEMI) patients with Primary PCI (PPCI). Stone, McDonnell, Richardson, Grines, O'Neill, & Jones (1998) concluded PPCI stents to be a safe alternative to thrombolysis in a majority of STEMI patients as their findings demonstrated excellent outcomes in the short term. The procedure has proved to be the most beneficial in terms of patient outcomes and hospital stay.

PPCI is recommended, by the European Society of Cardiology (ESC) (2008), as the first line of treatment for STEMI patients.

It is well known anxiety levels are high in the immediate time following an MI. Evidence has highlighted post MI depression can increase patient risk for further cardiac events (Frasure-Smith, Lespérance, Talajic, 1994). The introduction of routine PPCI over the last 5 years has seen patients discharged within three days of their initiating event (Laarman & Dirkson, 2010). There is little evidence to indentify if this results in a positive or negative effect on patient anxiety levels. Reports claim length of in-patient stay affects patient's ability to absorb information (Astin, Closs, McLenachan, Hunter, & Priestley, 2008b). It is possible a short stay in hospital could lead to increased anxiety due to less health professionals time spent on providing information and support to patients and their families. The National Infarct Angioplasty Project (2007) highlight concern regarding insufficient time allowed for patients and healthcare professionals to reflect, together, on events and discuss their next steps because the PPCI process was so fast. It is possible prolonged recovery or increased readmissions could be due to anxiety issues. Alternatively, anxiety levels may seem lower in PPCI patients as they underestimate the seriousness of their cardiac event, therefore failing to realise the importance of addressing lifestyle changes to prevent secondary events and compliance to medical treatment.

Recent changes to the Government NHS strategy (Secretary of State for Health, 2010), has emphasized the need for clinical practice to be more patient-centred. Understanding patients' experiences of treatment and exploring their needs will enable health services in their drive toward better patient care.

## 1.2 Cardiac Services in Bristol

CHD is one of the main causes of death in Bristol with a mortality rate of 109 per 100,000 people. From 2004 to 2006, forty eight percent of deaths in Bristol were due to CHD and twenty seven percent of all circulatory disease was aged under 75years.

This figure is predicted to rise as issues of obesity increase and the population ages (English Public Health Observatories, 2011).

Pre-hospital thrombolysis was implemented in Bristol in 2002 with rescue PCI accessed at Bristol Royal Infirmary (BRI) in 2004. Cardiologists piloted PPCI at the BRI in 2003. The success of PPCI interventions led to the development of the 'Optimum Reperfusion Programme' involving structured pathways for patients identified with STEMI (Kendall, 2007). By 2007, the BRI was set up to provide a twenty four hour PPCI service for their catchment area. The service extended to North Somerset, Bristol (North and South) and South Gloucester in 2009. BRI cardiac services currently provide a twenty-four hour a day service for the Gloucester, Wiltshire, Avon and Somerset network (GWAS) region. The introduction of PPCI and nurse led discharge has subsequently reduced BRI patients' length of stay to an average of 2.7 days following a STEMI (Oriolo & Tagney, 2011). Patients are seen by a Cardiac Rehabilitation Specialist Nurse prior to discharge. All MI patients are referred for Cardiac Rehabilitation at in-patient stage. Referrals are sent to patients local Cardiac Rehabilitation team if they are from out of area.

This study is a retrospective review of cardiology treatment for patients admitted to the BRI with an STEMI. Comparing PPCI and Thrombolysis patient outcomes will identify if a shorter hospital stay has an impact on patient's anxiety and depression levels, readmissions, mortality and if they remain compliant with lifestyle advice.

## 1.3 Aims and Objectives

The aim of this study is to compare patients treated with PPCI or thrombolysis to determine if outcomes remain consistent between treatments at the BRI. To achieve this aim, data was analysed to satisfy the following objectives:

i- Identify if PPCI results in more or less unplanned readmissions in STEMI patients compared to thrombolysis patients.

ii- Identify any significance in frequency and reasons for non-planned readmission to hospital between the two groups.

iii- Explore mortality rates between both groups.

iv- Identify if uptake of cardiac rehabilitation amongst PPCI differs to thrombolysis patients.

v - Identify if a shorter hospital stay following PPCI results in increased or decreased anxiety or depression compared to thrombolysis patients who remain in hospital for longer periods.

vi - Identify differences in anxiety and depression levels between PPCI and thrombolysis patients at phase two and three of cardiac rehabilitation in the Bristol area.

vii - Any significant difference in risk factor management between PPCI and thrombolysis patients

# 2. Literature Review

The literature available in respect of this study is limited in terms of comparing anxiety and depression for different STEMI treatments. However, the psychological aspect has been a growing concern in terms of patients who survive an MI. With PPCI being a relatively new procedure in terms of MI treatment, long-term outcomes have yet to be deduced. Many studies have identified issues with recovery of patients following diagnosis and treatment for CHD events. The following literature review demonstrates a vast overlap in terms of MI treatments and the influence of education, length of stay, patients' perceptions and social circumstances on the development of post MI complications, mortality, lifestyle, anxiety and depression. Results of such studies have enabled health care professionals to develop and modify treatments and interventions in order to provide the best possible outcomes for cardiac patients and their families and carer's.

## 2.1 What is a Myocardial Infarction?

The heart is an organ made of muscle called the myocardium. It contains chambers and valves that help move blood through the heart and lungs. Its function is to pump blood around the body, via arteries and veins, in order to supply blood and oxygen to organs and muscles. The heart needs its own blood supply to function. The vessels supplying blood to the heart are known as Coronary Arteries and Coronary Veins (Brubaker, Kaminsky, & Whaley, 2002). Heart disease develops over many years. Ross (1999) conducted extensive studies into the development of coronary artery disease. His studies revealed the development of atherosclerotic disease was caused by the accumulation of lipids in the artery walls. Ross went on to examine the effect of atherosclerosis and concluded it to be an inflammatory response that can lead to the formation of lesions within the arteries. High levels of plasma cholesterol, particularly

low density lipoprotein (LDL) cholesterol, builds up in damaged areas of the smooth muscle within the arteries. Damage can occur through smoking, high blood pressure, diabetes, genetic changes and high levels of LDL. As cholesterol adheres within the artery walls, a lesion is formed, also known as a fatty streak. The reaction of cells, such as macrophages and lymphocytes, respond to the damage and attempt to repair the arterial wall. The result is remodelling of the artery through thickening and fibrosis of the smooth muscle tissue. Eventually a fibrosis cap, known as plaque, will form to cover the lipid core. The pressure of the expanding lesion results in a protrusion into the arterial lumen, which restricts the flow of blood, known as ischaemia. Some people may experience symptoms of angina at this stage. Angina occurs when the heart is under exertion. The heart muscles demand for blood and oxygen increases but the restricted coronary artery cannot meet the demand. If undetected or untreated, the plaque will eventually rupture. The body responds to the rupture as it does with any damaged tissue and forms a thrombus or blood clot around the damaged area. This results in an occlusion of the artery, thus stopping the flow of blood to the heart muscle. The longer the myocardium is without a blood supply, the greater the risk of irreparable damage to the muscle cells, known as infarction. Myocardial cells begin to break down within 60 minutes of cessation of blood supply. A complete blockage of a coronary artery can be identified through changes to electrocardiograph (ECG) recordings known as ST elevation, thus the term ST elevation myocardial infarction (STEMI).

## 2.2 Treatments for an ST Elevation Myocardial Infarction

The National Institute for Clinical Excellence (NICE) (2002) produced guidelines recommending the use of thrombolytic drugs for the treatment of acute MI's. A review of studies into the use of the drug concluded it to be a safe and cost effective method of treatment. Thrombolytic drugs are administered intravenously and help to break

down the coronary thrombus to restore blood flow to the heart muscle. If restoration of blood flow is fast enough, the myocardium will sustain less permanent damage. Thrombolytic drugs is safely administered up 12 hours after the onset of STEMI symptoms. However, the treatment carries certain risks such as hypotension and bleeding due to the anti thrombolytic effect (National Institute for Clinical Excellence Appraisal Committee, 2002).

Gruentzig successfully introduced the use of balloon catheters for the treatment of occluded arteries in 1977 (Gruntzig & Kumpe, 1979b). Puel and Sigwart first implanted human stents in 1977 (Serruys, Kutryk, & Ong, 2006). The technique has developed over the years and today PPCI is recommended as the first line intervention for patients presenting with a STEMI (McLenachan, Machin, & Marley, 2009).

The procedure is performed with the patient fully awake. A fine bore catheter is introduced, percutaneously, through an artery, either femoral or radial. The catheter is guided to the aorta and positioned close to the coronary sinus. A radio opaque contrast is injected through the catheter and into the coronary arteries. Recorded angiographic images are examined by the cardiologist in order to locate the occlusion. A guide wire is then introduced into the catheter and placed at the point of the lesion. The tip of the guide wire consists of a small balloon with a mesh tube or stent compressed over the outside. When the guide wire tip is in place, the balloon is inflated causing the stent to expand and open the occluded artery. The balloon is deflated and removed, along with the catheter, leaving the stent in place (Brubaker, Kaminsky, & Whaley, 2002). Results are usually instantaneous and the patient begins to feel instant relief. A Danish study into effective treatment for STEMI patients identified the time between onset of symptoms and treatment influenced patient outcomes in terms of permanat myocardial damage and survival. Recommendations are that PPCI should be performed within 120 minutes of the patients initial call for help (DANAMI-2 Investigators, 2003) .

## 2.3 Anxiety and Depression post MI

Many studies explore the links with depression and CHD. Evidence has found strong associations of depression and death following an MI (table 1).

**Table 1: Literature relating to post MI anxiety and depression**

| Author & Year | Study Title | Group Type | Study Type | Assessment Tool | Size (*n*) | Findings |
|---|---|---|---|---|---|---|
| **Bush et al 2001** | Minimal Symptoms of Depression Increase Mortality Risk After AMI | MI | Prospective study | Structured Clinical Interview for DSM III R. Beck Depression Inventory | 285 | Highest mortality rates were in patients with most severe depressive symptoms. Compared with those without depression, higher mortality was also observed at very low levels of depressive symptoms |
| **Chung et al, 2007** | Co morbidity and personality traits in patients with different levels of posttraumatic stress disorder following MI | MI | Prospective control study | Posttraumatic Stress Diagnostic Scale. General Health Questionnaire-28. NEO-Five Factor Inventory | 120 | Following MI, those with full PTSD reported more severe co morbidity than those who have not developed PTSD fully. |
| **Chung et al, 2008** | Coping with posttraumatic stress disorder and co morbidity after MI | MI | Prospective research (post MI mean 5 to 7 years) | Posttraumatic Stress Diagnostic Scale, General Health Questionnaire, COPE Scale | 120 | 31% patients had PTSD Intervention increased PTSD. Avoidance increased co-morbidity symptoms i.e. depression |
| **Denollet et al, 1995** | Personality and Mortality After MI | MI | Prospective study | Social Inhibition scale of the Heart Patients Psychological Questionnaire. State Trait Anxiety Inventory. Millon Behavioural Health Inventory. | 105 men | The distressed personality type was associated with post MI mortality. |
| **Denollet et al, 2006** | Recognizing Increased Risk of Depressive Co morbidity after MI: Looking for 4 Symptoms of Anxiety-Depression | MI | Prospective trial | Psychiatric Interview. Beck Depression Inventory. Symptoms of Anxiety-Depression index | 176 | Symptoms of anxiety and depression co-occurred after MI. Mixed anxiety-depression was independently associated with depressive or anxiety disorder. |
| **Doering et al, 2009** | Persistent co morbid symptoms of depression and anxiety predict mortality in heart disease | IHD | Prospective randomized trial (3 to 12 months following MI) | Multiple Adjective Affect Checklist, Brief Symptom Inventory | 2,325 | 61.7% patients reported depression, anxiety or both. 3.8% of patient deaths within 12 months had both |
| **ENRICHD 2005** | Low Perceived Social Support and Post–MI Prognosis in | MI | Qualitative and Quantative Clinical | ENRICHD Social Support Instrument. Depression | 1,503 | LPSS risk reported improvement in perceived support, regardless of treatment. Significant treatment effect in LPSS group with no partner and |

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|---|---|---|---|---|---|---|
| | the Enhancing Recovery in CHD Clinical Trial | | Trial (29 months) | Interview and Structured Hamilton. Beck Depression Inventory | | moderate support at baseline. During 29-month follow-up, combined end point of death / nonfatal MI = 10% in MI comparison group and 23% in ENRICHD LPSS patients; LPSS conferred a greater risk in unadjusted and adjusted models. |
| **Frasure-Smith et al, 1995** | Depression and 18Month Prognosis After MI | MI | Prospective study | National Institute of Mental Health Diagnostic Interview Schedule. Beck Depression Inventory. | 222 | DIS and elevated BDI scores were significantly related to 18month cardiac mortality. Deaths were concentrated among depressed patients with premature ventricular contractions of more than 10 per hour. |
| **Kawachi, et al., 1994** | Prospective study of phobic anxiety and risk of CHD in men | CHD | Cohort (prospective 2 years) | Crown-Crisp experiential index | 33,999 men | No risk of phobic risk with non-fatal MI. High risk of fatal MI if phobic score > 3. Relative risk increases for men with a history of CHD. |
| **Linke et al, 2009** | Depressive Symptom Dimensions and Cardiovascular Prognosis Among Women With Suspected MI | MI | Cohort study (continuous follow-up median of 5.8 years post MI) | Beck Depression Inventory, Coronary Angiography | 550 women | Somatic but not cognitive affective / depressive symptoms were associated with an increased risk of cardiovascular-related mortality and events. |
| **May et al, 2009** | Depression After CAD Is Associated With Heart Failure | CAD | Prospective research (From CAD diagnosis to death or HF) | Anti-depressant medication (ADM), Clinical diagnosis | 13,708 | 10% post CAD had clinical depression. 16.4% with post CAD depression developed heart disease ($p < 0.0001$) |
| **Naqvi et al, 2005** | Gender Differences in the Link Between Depression and Cardiovascular Disease | MI and CHD | Literature review | None specific | Not specified | Depression delays recovery in women post MI and CABG. |
| **Pedersen et al, 2002** | The role of personality variables and social support in distress and perceived health in patients following MI | MI | Prospective study 4-6 weeks post MI | The Posttraumatic Diagnostic Scale. Trauma Symptom Checklist. Health Complaints Scale. Eysenck Personality Questionnaire. Personality Type D Scale. Crisis Support Scale. | 112 | Low social support = t increased risk of depression and PTSD. Less satisfaction with support = increased risk of anxiety, depression, PTSD, and more reported health complaints. Neuroticism was an independent predictor of all types of distress and health complaints. Satisfaction with support only remained an independent predictor of depression. |
| **Rees et al, 2004** | Psychological interventions for CHD | CHD | Systematic Review | Literature Review | Thirty six trials with 12,841 patients | Unclear results, but inclusion in rehabilitation programmes may help. |

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|---|---|---|---|---|---|---|
| **Roest et al, 2010** | Prognostic Association of Anxiety Post MI With Mortality and New Cardiac Events | MI | Meta-Analysis | Non specified | 12 Studies total 5750 patients average 2.6 years follow up | Anxious patients were at risk of adverse events. Anxiety was specifically associated with all-cause mortality, cardiac mortality and new cardiac events. Post-MI anxiety is associated with a 36% increased risk of adverse cardiac outcomes. |
| **Roest et al, 2010** | Anxiety and Risk of Incident CHD | CHD | Meta-analysis | None specified | 20 studies totalling 249,846 subjects | Anxious persons were at risk of CHD and cardiac death. There was a non-significant trend for an association between anxiety and nonfatal MI. |
| **Shen et al, 2008** | Anxiety Characteristics Independently and Prospectively Predict MI in Men | MI | Predictive Longitudinal Study (12.4 years) | Minnesota Multiphasic Personality Inventory (MMPI) | 735 men | Anxiety-prone dispositions appear to be a robust and independent risk factor of MI among older men. |
| **Stafford et al, 2009** | Are illness perceptions about CAD predictive of depression and quality of life outcomes? | CAD | Prospective research (3 and 9 months post vent) | Hospital anxiety and Depression (HADS), Health-Related Quality of Life (HRQOL). | 193 | Negative beliefs predict increased depression symptoms. Older and socially disadvantaged patients had greater negative beliefs. |
| **Thombs et al, 2008** | Usefulness of Persistent Symptoms of Depression to Predict Physical Health Status 12 Months After an ACS | ACS | Prospective research (12 months) | Beck Depression Inventory (BDI) Short Form 12 (SF 12) | 425 | Patients with persistent symptoms of depression were at risk of poorer physical health. Patients with newly developed depressive symptoms after ACS were at slightly increased risk for worsened physical health (p= 0.060), whereas patients with transient depressive symptoms were not at increased risk. |

Frasure-Smith, Lespérance, Talajic, (1994) identified elevated depression scores were related to 18 month cardiac mortality. They investigated a notable link of depression with cardiac arrhythmias and found a concentration of elevated depression scores and premature ventricular beats of more than 10 per hour among those patients that had died. Consequently, depression has remained of great interest to researchers with a view to further define its links with heart disease. However, less emphasis was placed on the effect anxiety has in relation to heart disease in the long and short term. However, recent introduction of new techniques to treat CVD and faster throughput in hospitals has influenced researchers to examine the effects of anxiety as well as depression on patients with CHD.

The Health Professionals Follow Up study took place in America from 1986. It involved a population of over 51,000 men. Analysis of the data involved identification of psychological and personality traits to find associations with CHD. The study group aimed to find links with self reported phobic anxiety and CHD (Kawachi, Colditz, Ascherio, Rimm, Giovannucci, Stampfer & Willett, 1994). Their findings were significant relative risks of fatal MI associated with a phobic anxiety score of three or more. Risks increased when the study's variable adjustments included men with a history of CHD. They found no links with non-fatal MI and phobic anxiety scores.

In support of Kawachi et al (1994) results, extensive studies into personality traits and their effects on patient mortality following an MI have further revealed significant links with depression and anxiety over the years. Denollet, Sys, Brutsaert, (1995) identified distressed personality types to have higher risks of post MI mortality.

Denollets continued investigations into psychological issues related to CHD, highlighted the issue of depression and anxiety being consistently overlooked in patients suffering an MI (Denollet, Strik, Lousberg, & Honig, 2006). They found levels of anxiety were high in patients with depression and was present in all with severe depression. The implications of co morbidity result in an increase risk of mortality and increase burden on health services emphasising the need to address anxiety as a core feature of depression assessing patients following an MI.

Further research has exposed anxiety as a predictor for MI. Shen, Avivi, Todaro, Spiro, Laurenceau, Ward & Niaura, (2008) identified anxiety as a significant risk factor in older men with no history of heart disease. Their study examined data from the Normative Ageing Study (NAS Boston). Analysis of various psychological and physical assessments of older men with a mean age of 60 years revealed them to be at risk of an MI within 12 years if they demonstrated moderate to high levels of anxiety. Their study concludes that severe levels of anxiety represent risks of MI that may

warrant medical attention. Meta-analysis of anxiety as a predictor of death and development of CHD compounds the theory of anxiety being an independent predictor of CHD and cardiac death (Roest, Martens, Jonge, & Denollet, 2010). Roest et al (2010) go on to declare anxiety post MI is associated with a 36% risk of adverse cardiac outcomes such as all cause mortality, cardiac death and new cardiac events (Roest, Martens, Jonge, & Denollet, 2010).

Evidence continues to indicate persistent anxiety and depression substantially increases the risk of death in patients with ischemic heart disease (Doering, Moser, Riegel, McKinley, Davidson, Baker, Meischke & Dracup 2009). After twelve months follow-up 23 of 608 (3.8%) of deaths were found to relate to patients with ischemic heart disease and persistent depression and anxiety.

Detailed studies of depression following ACS demonstrate patients with newly diagnosed depression symptoms are liable to experience greater poorer health issues than those with transient depressive symptoms (Thombs, Ziegelstein, Stewart, Abbey, Parakh, & Grace, 2008). Like Doering et al (2009) Thombs et al (2008) identified persistent depressive symptoms posed an increased risk of poor health 12 months after a diagnosis of ACS, highlighting the importance of assessing patients emotional status and psychological history after a cardiac event in order to manage their care and support during the weeks and months following their event.

May, Horne, Carlquist, Sheng, Joy, & Catinella, (2009) report a noticeable influence of depression post coronary artery disease (CAD) on heart failure. Patients were tracked over several years, from diagnosis to admission for heart failure or death. The information provided an insight into the long-term outcomes of patients with heart disease. Their study identified 16.4 % of patients presenting with depression following CAD diagnosis developed heart failure.

Even low levels of depression are found to carry a 50% risk of death within 4 months post MI. Bush, Ziegelstein, Tayback and Richter, (2001) identified the risk exists among patients older than 65 years with diabetes and less than 35% left ventricular ejection fraction.

The effect of psychosocial factors in patients with CAD has significant influences on increasing depression (Stafford, Berk, & Jackson, 2009). At three and nine months, post CAD event, patients' with negative illness perceptions demonstrated higher levels of depressive symptoms. Older and less socially disadvantaged patients' presented with greater negative beliefs than other subjects involved in the study. Monitoring patient social circumstances, particularly older patients, will aid in identifying those who need more support during the months following their event. Being aware of those most vulnerable will ensure they receive appropriate follow-up care. The study had certain restrictions, the authors expressed a concern that patients with depression were less likely to participate in the study. It was also noted men and women with CAD have different medical, functional and psychosocial profiles. This study was predominantly male.

A review by Naqvi, Naqvi, & Merz,( 2005) highlights the greater prevalence of depression in women than men following Myocardial ischaemia. Cognitive behaviour therapies showed conflicting results in women. However, women responded to Anti-depressant therapy more positively than men. Further prospective study is recommended to validate this claim.

The aforementioned theory is compounded by Linke, Rutledge, Johnson, Vaccarino, Bittner, Cornell, Eteiba, Sheps, Krantz, Parashar, Merz, (2009) who found women with somatic depressive symptoms such as insomnia and lethargy were of higher risk of cardiovascular related mortality and events. Implications of the results indicate

depression and cardiac mortality need more in depth investigation to understand their links.

Coping mechanisms after an MI are suggested to be symptom specific. Chung, Berger, & Rudd, (2008) identified posttraumatic stress disorder (PTSD) in 31% of MI patients in their study. Patients who used maladapted, emotional or avoidance coping strategies reported increased co-morbidity symptoms such as depression, anxiety, social dysfunction and negative illness perceptions (Chung, Berger, & Rudd, 2007). Furthermore, interventional treatments such as angioplasty or cardiac surgery resulted in increased PTSD symptoms. Chung et al (2007) expressed similar concerns as Stafford et al (2009) regarding patients who were in denial of their MI and consequently refused to be included in the study. It is possible the effects of PTSD could have a greater influence on patients who are in denial of their CHD but difficulties in gaining their consent to partake in research projects makes outcomes hard to predict.

In terms of social dysfunction, support and PTSD, Pedersen, Middel and Larsen, (2002) identified low perceived social support (LPSS) increases the risk of PTSD and depression. Post MI patients who expressed dissatisfaction with their social support demonstrated higher levels of anxiety, depression, PTSD and health complaints. Neurotic personality traits proved an independent predictor of distress and health complaints. Patient's perceptions of their social support and illness can influence their outcomes in the long term. The 'Enhanced Recovery in Coronary Heart Disease' (ENRICHD) clinical trial observed the effect of intervention for MI patients with low perceived social support (LPSS) depression and anxiety on recurrent MI or subsequent death (Writing Committee for the ENRICHD Investigators, 2003). Investigators found that although the intervention groups reported improved LPSS and depression, they

found no improvement on event free survival compared to the usual care or control group of post MI patients (ENRICHD Investigators, 2005).

A review of non-pharmacological psychological interventions for CHD patients found little improvement in patient outcomes although it was noted the studies included in the review were of poor quality (Rees, Bennett, West, Smith, & Ebrahim, 2004). The review noted slight reductions in anxiety and depression but no effect on mortality or life style management. Since the review was published, an increasing amount of interest in this subject has delivered significant information, enabling health professionals to understand the psychological effects CHD has on patients treated for MI, with a view to manage patient care accordingly, reduce re-admission and improve patient outcomes. Guidelines on management of anxiety recommend cognitive behaviour therapy and, relaxation therapy as an effective evidence based treatment for patients with anxiety issues (National Collaborating Centre for Mental Health, 2011). Despite the recommendations, the guidelines acknowledge General Practitioners (GP) are more likely to offer pharmacological treatments due to limited availability of recommended therapies. However, the evidence for depression, anxiety and lack of social support is conclusive in its links with mortality in relation to cardiac disease. These types of patients are in need of greater support and education at the point of diagnosis or identification of risk. Implications of identifying patient issues in the early stages post MI can help to influence patient outcomes, quality of life and the risk of recurring events. Further study is necessary to ascertain the most effective way of managing these risks and improving availability in order to improve life expectancy.

## 2.4 Risk Factors

The 1950's saw the recognition of the relationship between lifestyle and heart disease. The Framingham Heart Study commenced in 1948. The study observed health and social progress of the population of Framingham, Massachusett in America. It is an

ongoing study continues to this day. The Framingham study revealed strong links with the development of heart disease and risk factors such as cholesterol, diabetes, blood pressure, diet, weight, activity, alcohol and smoking (Dawber, Meadors, Moore, 1951). The study opened the way forward for scientists to investigate how life style influences the development of heart disease with a view to effectively treat and educate patients. In recent years definitive guidelines have been introduced to ensure consistent delivery of healthcare and education to people at risk such as the British Association of Cardiac Rehabilitation (BACR) (Coats, McGee, Stokes, & Thompson, 1995).

### 2.4.1 Cardiac Rehabilitation

Comprehensive cardiac rehabilitation programmes are known to reduce patient all cause mortality by 27% (Jolliffe, Rees, Taylor, Thompson, Oldridge, & S, 2001). An update on Jolliffe et al (2001) original review has also found cardiac rehabilitation significantly reduces hospital readmissions within 12 months follow-up of initiating event (Heran, Chen, Ebrahim, Moxham, Oldridge, Rees, Thompson & Taylor, 2011). Introduction of the National Service Framework (NSF) (Department of Health, 2000), set an aim for 85% of eligible revascularised patients to be offered cardiac rehabilitation by 2010. The NSF set clear guidance on service delivery based on guidelines laid out by the Scottish Intercollegiate Guideline Network (SIGN) (Scottish Intercollegiate Guidelines Network, 2002) and the British Association for Cardiovascular Rehabilitation (BACR) (Coats, McGee, Stokes, & Thompson, 1995). The NSF enabled healthcare workers and Cardiac rehabilitation teams to develop effective services for people at risk of heart disease and secondary events. The Cardiac Rehabilitation Service at South Bristol models the service accordingly with a view to educate patients on the effect of lifestyle issues on CHD and ways to manage relevant risk factors accordingly.

The Cardiac Rehabilitation patient pathway follows four phases:

Phase I. In-patient stage: A patient is admitted to hospital with a cardiac event such as a Myocardial Infarction (MI), Cardiac Surgery, or PCI for stable or unstable angina. Medical management commences and correction of acute disease takes place. . Immediate post event: advice and psychological support begin at this stage. The Cardiac Rehabilitation Specialist Nurse initiates patient and carer education on the wards

Phase II. Discharge: Telephone or letter contact. Patients are invited to attend a clinic assessment with a view to assess recovery and risk factors, offer advice and support. Clinic appointments allow an opportunity for patients to learn more about the next phase of Cardiac Rehabilitation. South Bristol resources limit the service to hospital and outpatient assessments, but do not allow for home visits as suggested by SIGN (2002).

Phase III. Intermediate outpatient: The patient is invited to attend a comprehensive Cardiac Rehabilitation programme within 3 to 6 weeks post event. The programme is one day a week and runs for 8 weeks as a rolling programme. Cardiac Rehabilitation Specialist Nurses and physiotherapists facilitate the sessions. Each session consists of exercise, education of risk factor management and psychological support. Service delivery varies for different Cardiac Rehabilitation services throughout the UK depending on available resources.

Phase IV. Long-term maintenance: Patients are encouraged to continue with exercise and lifestyle change. Structured phase 4 exercise programmes run by instructors trained by the BACR (Coats, McGee, Stokes, & Thompson, 1995) are available throughout Bristol. Cardiac Rehabilitation Specialist nurses liaise with Bristol City Sports management regarding patient referrals for phase IV exercise

groups. Monitoring risk factors continues with Primary Care Teams (PCT) (Scottish Intercollegiate Guidelines Network, 2002).

Many clinical studies focus on pharmacological trials for the improvement of CHD patient outcomes. The Joint British Society (JBS2) (2005) expressed concerns regarding the lack of clinical evidence regarding risk factor management in CHD.

However, evidence from systematic reviews, meta-analysis and random controlled trials have enabled organisations such as the British Association for Cardiac Rehabilitation, SIGN and the NSF to lay out guidelines enable health professionals to advise and educate patients in secondary prevention.

The NICE emphasise the importance of secondary education for MI patients, highlighting cost effectiveness of risk factor education (National Institute for Health and Clinical Excellence, 2007).

### 2.4.2 Blood pressure

NICE (2011) recommend lifestyle management as the first line intervention for treatment of hypertension. They recommend blood pressure to be less than 140 systolic and 90 diastolic. Reductions in blood pressure up to 20 millimols of mercury (mmHg) systolic or 10mmHg diastolic significantly reduces risks of mortality from strokes or heart disease (Lewington, Clarke, Qizilbash, Peto, & Collins, 2002). The evidence is particularly relevant to middle age 40 to 49 years, with a twofold reduction in risks. NICE (2011) recommend relaxation is included in lifestyle management of hypertension. Collated evidence demonstrates a reduction of at least 10mmHg in systolic blood pressure among 33% of hypertensive patients practising relaxation once a week. Ongoing investigations into the effect of stress and relaxation on nitrous oxide (NO) levels have, to date, revealed increased NO levels are associated with relaxation

(Dusek & Benson, 2009). The effect NO has on smooth muscle in the arteries is thought to explain reductions in blood pressure for those who practice relaxation on a regular basis. The authors claim patients medication has been reduced as a result of continued relaxation. Further evidence is necessary to support this claim and identify relaxation as an independent predictor of blood pressure reduction. The study is ongoing, but current results highlight the effectiveness of relaxation as not only a physical benefit, but also a cost effective one.

### 2.4.3 Obesity

Obesity links closely to cardiovascular disease. Increased weight relates to increased adipose tissue and total blood volume. Resulting in a higher cardiac output, poor left ventricular (LV) function, reduced adipose tissue perfusion and increased peripheral vascular resistance (Poirier, Giles, Bray, Hong, Stern, Pi-Sunyer et al, 2006). Neter, Stam, Kok, Grobbee and Geleijnse, (2003) describe associations of weight and blood pressure. Obesity subjects presented with over activity in the renin, angiotensin and aldosterone system causing increased renin activity and higher concentrations of aldosterone, thus an increase in blood pressure. Their study reported significant reductions in blood pressure when subjects lost weight. A loss of 1 Kilogram of weight equates to a reduction of 1.05 mmHg in systolic and 0.92 mmHg diastolic blood pressure. Obesity as an independent risk for CHD is also contributory to other factors such as diabetes and hypertension, which is more prevalent in overweight subjects (Poirier, Giles, Bray, Hong, Stern, Pi-Sunyer et al, 2006).

Clinical evaluation of obese patients outcomes following acute coronary events revealed unexpected outcomes (Eisenstein, et al., 2005). Although very obese subjects were found to have poorer intermediate survival rates, so were patients with a healthy body mass index (BMI). Patients classed as overweight and obese had better intermediate survival rates during the 30, 90 day and one year study period. The study

found death and MI rates similar for all groups, but recommended further investigation into outcomes for healthy weight patients. However, Murphy, MacIntyre, Stewart, Hart, Hole, & McMurray, (2006) examined long term consequences of obesity over a 20 year period. They conclude obesity is associated with a broad range of fatal and non-fatal cardiovascular events. From their study results indicated 9 additional cardiovascular deaths and 36 additional hospital admissions per 100 affected middle aged men over 20 years. With obesity becoming an increasing problem in the UK, Murphy et al predict the problem will only increase over the next 20 years. NICE (2006) have been striving to change public attitudes towards obesity by setting guidelines for schools, communities and health professionals to educate and motivate people into adopting a healthier approach to life.

### 2.4.4 Diet

In response to Department of Health concerns, NICE (2010) produced guidelines for prevention of CVD at population level. Recommendations are for supportive litigation to encourage food manufacturers to adjust marketing strategies in order to reduce salt and fat content in products thus contributing to reduction in general public salt and fat intake. NICE (2010) acknowledge associations of salt with blood pressure. General salt intake and blood pressure has increased in the UK since initial introduction of guidelines in 1994 recommending the daily salt intake should amount to less than 6 grams per day. Evidence has led to the belief that higher sodium levels result from reabsorbtion in the renal system and stands as an independent response of blood pressure to salt in hypertension (Chiolero, Maillard, Nussberger, Brunner and Burnier, 2000). The effect of increased sodium intake was found to have an impact on the neuropathic system and its regulation of the cardiovascular system (Coruzzi, Parati, Brambilla, Brambilla, Gualerzi, Novarini et al, 2005). Their study, although small (n= 34) identified a correlation between impairment of parasympathetic cardiac control and an increase in of salt sensitivity. As part of a study

into high protein, low carbohydrate and high mono-unsaturated fat diet in type 2 diabetics, Parker, Noakes, Luscombe & Clifton, (2002) evidence revealed decreased LDL levels, weight, abdominal fat and blood pressure. Female response produced better results with a high protein diet whereas men achieved the same results on a low protein diet. Recommendations post MI suggest a Mediterranean style diet, which includes oily fish, fruit, plant oils, more, bread and less meat and dairy products, as a means to prevent secondary events ( National Institute for Health and Clinical Excellence, NICE, 2007). Low carbohydrate diets increase HDL levels and improve ratio of total cholesterol to HDL, whereas the Mediterranean diet influences reduction in LDL levels. Furthermore, low carbohydrate and Mediterranean diet have produced more favourable results than low fat diets in respect of weight loss, improving metabolic effects and glycaemia control (Schwarzfuchs, Henkin, Shahar, Witkow, Greenberg, Golan et al, 2008).

### 2.4.5 Exercise

Ballor and Poehlman (1992) compared aerobic training, resistant training and sedentary groups for fitness and metabolic outcomes. They established resistant training showed improvements in fitness but aerobic exercise had a significantly better effect on metabolic rate and peak oxygen consumption (VO2) resulting in increased fitness and improved lipid levels. Wosornu, Bedford and Ballantyne, (1996) found combining aerobic exercise and resistant exercise resulted in improved fitness levels, increased weight loss and reduced body fat compared to aerobic exercise alone. Further evidence supporting their study agrees combining regular aerobic and strengthening exercises has a positive effect on HDL levels and results in a significant decrease in total cholesterol, LDL and triglycerides (Moghadam, Tavakol, Hadian, Bagheri, Jalaei, 2009). Their study, comparing aerobic only exercise with combined strength and aerobic protocols, concludes an element of strengthening or resistant exercise can have beneficial results for CHD patients. The effect aerobic exercise has

on blood pressure primarily reduces systemic vascular resistance, involving the sympathetic nervous and renin angiotensin systems, therefore influencing blood pressure reduction. Trial results show resting blood pressure reduced by 6.9mmHg systolic and 4.9 mmHg diastolic through aerobic exercise (Fagard and Cornelissen, 2007). Moghadam et al (2009) conducted their trial on CABG patients over a three month period. However, exercise will assist in maintained reduction in triglyceride levels and increased HDL levels providing weekly regimes of brisk walking or jogging are consistent (Durstine, Grandjean, Cox, Thompson, 2002).

### 2.4.6 Alcohol

NICE (2007) recommend alcohol consumption should be limited, for post MI patients, to no more that 3 to 4 units per day for men, 2 to 3 units for women. The daily recommendation is set as an intention to steer people away from binge drinking. Frequent alcohol consumption at a moderate rate of 3 to 4 days per week is associated with lower risks of myocardial infarction (Mukamal, Jensen, Grønbæk, Stampfer, Manson, Pischon & Rimm, 2005). Their study of men and women over the course of eight years, found positive effects on HDL, fibrinogen and haemoglobin A amongst those who drank a moderate amount of alcohol over a 3 to 7 day period. Previous review of studies into alcohol confirmed light consumption of alcohol increases HDL, reduces triglycerides and also has beneficial effects on the development of atherosclerosis through enhancement of insulin sensitivity (O'Keefe, Bybee, & Lavie, 2007). Their review identifies heavy alcohol use results in declining ejection fraction and progressive left ventricular hypertrophy leading to alcohol induced cardiomyopathy. Furthermore, they suggest alcohol is known to be high in calories and can lead to abdominal obesity, which is associated with reduced HDL levels.

### 2.4.7 Smoking

It was not until the 1960's that smoking and links with heart disease became apparent. One study identified only 2.5% of male participants with atherosclerosis were non-smokers (Juergens, Barker, Hines, 1960). They identified smoking to be a contributing factor to arterial thrombosis in atherosclerosis. Smoking continues to be a main cause of preventable premature death and morbidity in the UK (National Institute for Health and Clinical Excellence Guidance Committee, 2008). Smoking is reported to cost the NHS over £1 billion pounds per year through related illness. Research identified smokers had a 50% increase in atherosclerotic disease compared to non-smokers (Howard, Wagenknecht, Burke, Diez-Roux, Evans, McGovern, et al, 1998). Further to this, the study found increased levels, 25%, of progressive atherosclerosis in non-smokers who were exposed to a smoking environment. In support of Howard et al (1998) findings, Law, Morris and Wald, (1997) identified exposure of non-smokers to environmental smoke increases platelet aggregation resulting in a 34% increase risk of ischaemic heart. Combine smoking or passive smoking with other CVD risk factors and it is plain to understand Department of Health concerns on the needless costs to the health service and are currently investing in campaigns to encourage smoking cessation.

### 2.4.8 Anxiety, Depression and Risk Factors

Certain behaviours leading up to CVD events are associated with psychological distress. Studies into post MI patient outcomes are enabling health professionals to gain a better understanding in order to improve patient journeys following their cardiac event (table 2).

Hamer, Molloy, & Stamatakis, (2008) identified behavioural activities were strongly associated with psychological distress and the lead up to CVD events, predominantly

smoking and lack of exercise. Hypertension and C - reactive protein (CRP) levels posed a moderate risk.

After an MI, anxiety alone has an influence on patients' adherence to risk reducing advice (Kuhl, Fauerbach, BushRoy, & Ziegelstein, 2009). Kuhl et al (2009) investigated post MI anxiety levels and found higher levels were linked with patients who did not adhere to advice, smoking cessation in particular. However, these patients were more likely to carry supplies (sub-lingual nitro-glycerine). The author speculates patients with higher anxiety levels may be concerned about ongoing chest pain or feel less anxious by carrying supplies.

Incidental information from Kuhl et al (2009) revealed patients who live alone were more likely to have elevated anxiety levels at four months post MI. Social circumstances should be of prime consideration for health professionals assessing patients during initial admission. Their study found no relationship with patient length of stay in hospital but noted female gender, age, depression and hypertension were more likely to have higher anxiety levels at baseline over time.

An early study of patients' experiences and their perceptions found the more negative perceptions are, the less likely they are to return to work, recreational activities and social interaction (Petrie, Weinman, Sharpe, & Buckley, 1996). Sexual dysfunction increased in patients with stronger illness identity. Cardiac rehabilitation attendance was better for patients who believed their illness to be curable or controlled.

The Manchester Heart Centre is currently conducting extensive studies into the outcomes of patients re-admitted to hospital following PPCI for STEMI. The main point of interest is re-admission rates for PPCI patients. Published interim results note readmitted PPCI patients report receiving insufficient information or follow-up post MI (Iles-Smith, McGowan, Rogers, Fath-Ordoubadi, Dickens, & Deaton, 2009).

The study identified negative perceptions of patients such as anger and uncertainty of symptom recognition along with a loss of confidence. Further analysis of the Manchester study revealed Global Registry of Acute Cardiac Events score (GRACE) to be higher in PPCI patients at baseline along with HAD scores indicating better clinical outcomes (McGowan, Iles-Smith, Dickens, Campbell, Rogers, & Fath-Ordoubadi, 2011). The COURAGE trial incorporated a comprehensive nurse led lifestyle management programme into their study where patients received counselling and lifestyle advice at six monthly intervals until the end of the study (Maron, Boden, Weintraub, Calfas, & O'Rourke, 2011). The overall results conclude time spent with patients, regardless of their treatment, results in improvements of lifestyle and modification of risk factors.

**Table 2: Literature relating to risk factors and lifestyle management in cardiac disease**

| Author & Year | Study Title | Group Type | Study Type | Assessment Tool | Size (*n*) | Findings |
|---|---|---|---|---|---|---|
| **Hamer et al, 2008** | Psychological Distress as a Risk Factor for Cardio-vascular Events | Pre CVD events | Prospective research (average of 7 years to point of CVD event) | Scottish Health Survey (SHS), General Health Questionnaire, Behavioural and patho-physiology risk factors | 6,576 | CVD risk increased in relation to psychological distress in age and sex. Behavioural factors explained the largest proportion of variance. Patho-physiological factors account for a modest amount. |
| **Iles-Smith et al, 2009** | A qualitative study of the experiences of MI patients who represent post-PPCI | PPCI | Qualitative study | Interviews | 17 | A great deal of uncertainty, anger and anxiety exits in relation to symptom recognition. Loss of confidence and inability to make sense of symptoms featured highly. Patients attempted to construct illness events and reported receiving insufficient information or follow-up post-primary PCI. |
| **Kuhl et al, 2009** | Relation of Anxiety and Adherence to Risk-Reducing Recommendations Following MI | MI | Prospective research (MI to 4 months post event) | Beck Anxiety Inventory | 278 | High anxiety levels 4 months post MI resulted in worst adherence to exercise, stress management, increasing socialisation and smoking cessation in particular. Better adherence to carrying supplies High anxiety levels 4 month post MI in patients living alone. |
| **Maron et al COURAGE, 2007** | Optimal Medical Therapy with or without PCI for | Stable CAD | Randomized Clinical Trial | PCI v Medical Treatment | 2,287 | PCI did not reduce the risk of death, myocardial infarction, or other major cardiovascular |

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| | Stable CAD | | | | | events when added to optimal medical therapy. |
| **McGowan et al, 2011** | The relationship between psychological factors and impaired health-related quality of life post STEMI | STEMI PPCI v Thrombolysis | Prospective cohort | Charlson Co morbidity Index. Illness perceptions. Hospital Anxiety and Depression Scale. Health-related quality of life (SF-36). SF-36 Physical Component Score | 385 | Higher GRACE scores for PPCI group. No differences in LV function. Thrombolysis patients had more co morbid illness. Total HADS score was significantly higher in the PPCI vs Thrombolysis group at baseline. Raised levels of depression and anxiety predicted impairment in health-related quality of life at 6 months post-STEMI, regardless of mode of treatment. |
| **Petrie et al, 1996** | Role of patients' view of their illness in predicting return to work and functioning after MI | MI | Prospective trial | Illness Perceptior Questionnaire. Sickness Impact Profile. Four Item Sexual Functioning Scale. | 143 | Attendance at the rehabilitation course related to stronger belief, during admission, that illness could be cured or controlled. Return to work within six weeks was predicted by perception of illness lasting a short time and having fewer consequences for the patient. Patient belief that heart disease would have serious consequences, related to later disability in work around the house, recreational activities, and social interaction. Strong illness identity significantly related to greater sexual dysfunction at both three and six months. |

Study results indicate a need to assess patient perceptions and commence early education following their MI to ensure they have appropriate understanding of their condition and long term implications.

## 2.5 Pre-discharge Information

Motivating patients to change their lifestyles has proved quite a challenge to health educators and providers. Information and education plays an important part in patient outcomes in the long term after their MI. Many studies have investigated the most effective way to influence patients to examine their lifestyle and make appropriate adjustments to improve their quality of life and reduce mortality rates (table 3).

Secondary prevention and education often commences during patients' hospital admission following their cardiac event. Duryee, (1992) reviewed 21 studies conducted between 1975 and 1989 regarding in-hospital education for MI patients. Overall results highlighted risk factors as their primary concern. The level of anxiety did not affect patients ability to learn new information, especially regarding activity. The effect of inpatient education stimulated some lifestyle change post discharge, particularly smoking cessation and activity. In terms of teaching methods, the review found audiovisual methods were as effective as one to one patient teaching. Evidence in general demonstrates that early education has a positive effect on patients' perceptions and lifestyle management.

The effectiveness of various levels of secondary prevention can influence patient all cause mortality (Auer, Gaume, Rodondi, Cornuz, & Ghali, 2008). Trained health care professionals following global systems of care, such as critical pathways, can significantly reduce mortality for ACS patients in the long term by providing direct counselling and education to the patient while in hospital. However, Auer, et al (2008) admit their study is not definitive and further research is needed to examine which components of secondary interventions produce the greatest benefits to patients and health services.

In-hospital complications were found to rise for each unit increase on the 'Illness perception' score (Cherrington, Moser, Lennie, & Kennedy, 2004). Anxiety and depression did not appear to affect the incidence of complications prior to patients discharge. However, post MI complications correlated with negative illness representations. Huffman, Smith, Blais, Januzzi, & Fricchione, (2008) also examined the effect of anxiety on patients post MI to identify independent associations with in-hospital complications. Their study of 110 subjects concluded post MI anxiety is

significantly associated with in-hospital cardiac complications. They consider it an independent predictor of such events.

Further evidence supporting Huffman et al (2008) suggest higher anxiety levels in-hospital post MI can pose a physical risk of arrhythmic and ischemic complications (Moser, Riegel, McKinley, Doering, An, & Sheahan, 2007). Mosers continued studies revealed the impact of one to one nursing intervention prior to discharge enabled patients to feel in control of their symptoms and demonstrated significant reduction in post MI anxiety levels (Moser, McKinley, Doering, Meischke, Pelter, Davidson, Baker & Dracup, 2010).

Timing of patient education and interventions are key to their long term outcomes. The introduction of PPCI treatments for STEMI has led to patients being discharged sooner. Concerns are being raised regarding time allowed for patient education prior to discharge and the effect on their recovery. Fredericks, (2009) examined the effect of timing education to patients post coronary artery bypass graft. The findings revealed no significant difference to patients outcomes whether given individualised education prior to or post discharge. However, patient anxieties were identified to be higher in the 24 hours prior to discharge than at any time during the three weeks following discharge home. The implications of this study suggest management of patients anxiety should be a priority before they are discharged home. However, CABG patients are often elective and have had time to prepare for their admission, this may in turn impact on their anxiety levels post surgery. MI patients have no pre-emption of their circumstances Fredericks study may produce different outcomes with MI patients. Little guidance is available to suggest how anxiety management is best delivered to MI patients. The BRI cardiac rehabilitation specialist nurses aim to see all MI patients on the wards prior to their discharge. Each visit takes approximately an hour. The time is used to ensure the patient understands what a heart attack is and

what treatment they received, including advice on medication and its effects. The patient is advised about building up activities and managing specific risk factors over the following weeks.

Early intervention can result in positive outcomes as Petrie, Cameron, Ellis, Buick, & Weinman, (2002) identified. Not only did patients demonstrate positive changes in their views and misconceptions of their MI, but they also returned to work sooner and presented with fewer angina symptoms at three months post event. The uptake of Cardiac Rehabilitation, however, remained the same for the intervention and control groups.

Smoking cessation is a tough challenge, McBride, Emmons, & Lipkus, (2003) examined the most appropriate 'Teaching Moment' for health behaviours. The most favourable results related to advising patients to stop smoking. Their findings suggested pregnancy and in hospital smoking advice resulted in a high percentage of smokers successfully stopping, up to 78%. However, visits to a clinic or abnormal test results did not produce such favourable results. The study suggests educating patients who smoke when admitted to hospital for an acute event may contribute towards a more favourable outcome.

**Table 3: Literature relating to pre-discharge information for Cardiac Patients**

| Author & Year | Study Title | Group Type | Study Type | Assessment Tool | Size (*n*) | Findings |
|---|---|---|---|---|---|---|
| **Auer et al, 2008** | Efficacy of In-Hospital Multidimensional Interventions of Secondary Prevention After ACS | ACS | A Systematic Review and Meta-Analysis | Systematic review | 14 Studies | Before-after studies suggest reduced mortality. Interventions including provider or system-level intervention suggested reduced mortality compared with patient-level only interventions. |
| **Cherrington et al, 2004** | Illness Representation After AMI: Impact On In-Hospital Recovery | MI with PCI | Prospective Correlation | Illness Perception Questionnaire. Spielberger State Anxiety Inventory. Beck Depression Inventory. | 49 | Negative illness perceptions increase in hospital complications. Anxiety and depression have no significant effect. |

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| | | | | Interviews. | | |
| **Duryee, 1992** | The efficacy of inpatient education after MI | MI | Literature review | None specified | 21 studies between 1975 & 1989 | Risk factors were patients primary concern. Anxiety did not affect patients ability to learn. Inpatient education stimulated some lifestyle change post discharge, particularly smoking cessation and activity. Audio visual methods were as effective as one to one patient teaching. |
| **Frederic ks, 2009** | Timing for delivering individualized patient education intervention to CABG patients | CABG | Randomized control trial (3 weeks) | Patient Learning Needs Scale, 15-item Knowledge Inventory, Revised Heart Failure Self-Care Behaviour scale (RSCB), Symptom Inventory, State Anxiety Scale | 172 | No significant outcomes in timing of education whether pre or post discharge. Patient anxiety levels are significantly higher during the 24 hours prior to discharge. |
| **Huffma n et al, 2008** | Anxiety, independent of depressive symptoms, is associated with in-hospital cardiac complications after AMI | MI | Prospective study 72 hours post MI | Beck Anxiety Inventory Beck Depression Inventory-II Interviews | 110 | MI anxiety was significantly associated with in-hospital cardiac complications. Post-MI anxiety remained an independent predictor of cardiac complications |
| **McBride et al, 2003** | Understanding the potential of teachable moments: the case of smoking cessation | Smokers | Systematic review | Literature review | 160 Studies | Cessation rates associated with pregnancy, hospitalization and disease diagnosis were high (10–60 and 15–78%, respectively), whereas rates for clinic visits and abnormal test results were consistently lower (2–10 and 7–21%, respectively). |
| **Moser et al, 2007** | Impact of Anxiety and Perceived Control on In-Hospital Complications After AMI | MI | Prospective research | Brief Symptom Inventory | 536 | Anxiety during the in-hospital phase of AMI is associated with increased risk for in-hospital arrhythmic and ischemic complications independent of traditional socio-demographic and clinical risk factors. The combination of high anxiety and low perceived control is associated with the highest risk of complications |
| **Moser et al, 2010** | The impact on anxiety and perceived control of a short one-on-one nursing intervention designed to decrease treatment seeking delay in people with CHD | Coronary Artery Disease | Randomized control trial | Multiple Affect Adjective Checklist | 3,522 | Interventions in which cardiac patients directly confront the possibility of an acute cardiac event do not cause anxiety if they provide patients with appropriate strategies for managing symptoms. |

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| **Petrie et al, 2002** | Changing Illness Perceptions After MI | MI | Early Intervention Randomized Control Trial (pre-discharge & 3 months) | Illness Perception Questionnaire | 65 | Intervention caused significant positive changes in patients' views of their MI. The intervention group reported being better prepared for leaving hospital and subsequently returned to work faster than the control group. 3-month follow-up, the intervention group reported a significantly lower rate of angina symptoms than control subjects. There were no significant differences in rehabilitation attendance between the two groups |

It is evident that patient education is important prior to discharge from hospital following an MI. Study results demonstrate faster return to work, compliance with smoking cessation, fewer related symptoms and generally more positive outcomes. It is also vital that education continues after discharge to ensure better outcomes for patients. The time patients spend with health professionals at the earliest opportunity following their cardiac event can be invaluable to their outcomes in the longer term.

## 2.6 Comparing PPCI to Thrombolysis

Before the introduction of PPCI, patients from the Avon, Gloucester, Wiltshire and Somerset areas were often transported to the BRI for rescue PCI if thrombolysis failed pre-admission or at their local emergency department. The success of PPCI on patient outcomes has resulted in the procedure being routine treatment for MI patients Bristol and the UK in general (table 4).

**Table 4: Literature comparing thrombolysis and PPCI**

| Author & Year | Study Title | Group Type | Study Type | Assessment Tool | Size (*n*) | Findings |
|---|---|---|---|---|---|---|
| **COURAGE, 2007** | Optimal Medical Therapy with or without PCI for Stable CAD | Stable CAD | Randomized Clinical Trial | PCI v Medical Treatment | 2,287 | PCI did not reduce the risk of death myocardial infarction, or other major cardiovascular events when added to optimal medical therapy. |
| **Every et al 1996** | A Comparison of Thrombolytic Therapy with PCA for AMI | MI | Retrospective study | Patient data | 1050 PPCI 2095 Throm-bolysis Total= 3145 | There was no significant difference in mortality during hospitalization or long-term follow up between patients in the thrombolytic and primary angioplasty group. Rates of procedures and costs were lower among the thrombolytic group both a |

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| | | | | | | the time of hospital discharge and three years follow-up. |
| **Keeley, Boura, & Grines, (2006)** | Comparison of primary and facilitated percutaneous coronary interventions for ST-elevation myocardial infarction: quantitative review of randomised trials | STEMI | Clinical Trial | Patient Data | 4504 | Facilitated patients had higher mortality, re-infarction, in-stent restenosis, bleeding and strokes than PPCI and is not recommended. |
| **PAMI Study Group, 1993** | A Comparison of Immediate Angioplasty with Thrombolytic Therapy for AMI | STEMI | Randomized clinical trial | Randomized allocation | 395 | Compared with tPA therapy for acute myocardial infarction, immediate PTCA reduced the combined occurrence of nonfatal re-infarction or death, was associated with a lower rate of intracranial haemorrhage, and resulted in similar left ventricular systolic function. |
| **PAMI Study Group, 1999** | Long-Term Outcome After PPCI: (PAMI-I) Trial | PPCI | Randomized clinical trial | PPCI or Throm-bolysis for STEMI | 395 | At two years, primary angioplasty had less recurrent ischemia, lower re-intervention rates and reduced hospital readmission rates. Angioplasty is independently predictive of a reduction in death, re-infarction or target vessel revascularization. |

In hospital deaths were reduced by over 50% for STEMI patients treated with PPCI during initial trials (The Primary Angioplasty in Myocardial Infarction Study Group, 1993). Furthermore, recurrent MI, death and intra-cranial bleeds were reduced during the six months following the initial event. Left ventricular function remained equal between the two groups. Later reports revealed PPCI to have favourable results in terms of re-infarction, readmission, re-intervention and death over a two year period compared to thrombolysis (The Primary Angioplasty in Myocardial Infarction I Study Group, 1999).

Clinical trials comparing PPCI to facilitated patients receiving PCI following thrombolysis produced definitive results (Keeley, Boura, & Grines, 2006). Facilitated PCI involved STEMI patients receiving thrombolysis prior to PCI with the intent to improve coronary patency. Thrombolysis resulted in increased deaths and reinfarction

compared to PPCI. Furthermore, patients were more likely to present with restenosis of the treated artery. Patients were also more likely to bleed or suffer a stroke following the procedure. The study does not recommend the use of facilitated PCI in any circumstance.

The Myocardial Infarction Triage and Intervention Project (MITIP) involved a Cohort of 12,331 patients admitted to Seattle Hospitals between 1988 and 1994. A comparison study of patients treated with PPCI or thrombolysis was implemented on the strength of the MITIP data (Every, Parsons, Hlatky, Martin, & Weaver, 1996). They found no significant differences between the two treatments in terms of mortality in hospital or during the three years follow up. They did find, however, that the PPCI treatment was more costly and thrombolysis patients required fewer procedures during the three year follow-up. Costs remain to be a contention in terms of NHS treatments for MI patients. The Heart Improvement guide (McLenachan, Machin, & Marley, A Guide to Implementing Primary Angioplasty, 2009) addresses this issue and suggests patients undergoing Thrombolysis are inevitably readmitted for PCI within six months of their initial event, whereas PPCI brings the inevitable procedure forward. The guide suggests the introduction of PPCI will reduce costs in the long term.

The Clinical Outcomes Utilizing Revascularization and Aggressive Drug Evaluation trial (COURAGE) (2007) compared outcomes for patients with stable CAD treated with medication only or PCI with medication. The results to date indicate no significant changes to the risk of death, MI or other major cardiovascular events when PCI was added to optimum medical therapy. However, PCI patients had a lower incidence of treatment for recurring angina symptoms (21% vs. 32.6%) during the first 36 months. The difference evened with medically treated patients after that time span. This poses the question of how much emphasis physicians place on lifestyle and long-term management. Patients treated medically may be more aware of their chronic

disease and so are more inclined to make lifestyle changes, whereas, as Astin et al (2008b) found, PCI patients may believe their PCI intervention equates to a cure for their disease and become complacent about modifying their lifestyle.

## 2.7 Length of Stay

The introduction of PPCI has resulted in patients spending less time in hospital.

The average stay for STEMI patients treated through thrombolysis was 5 days. Hosbond, Hansen, & Thomsen, (2007) concluded it safe to discharge patients within four days post PPCI for STEMI. They identified death and rehospitalisation was very low within 1 year of the initiating treatment. Several studies have addressed length of stay following treatment for STEMI (table 5), Laarman & Dirkson, (2010) reviewed evidence regarding PPCI and thrombolysis patient discharge. They conclude PPCI patients are safely discharged at three days post event but emphasise provision of costs should be made for a minority of patients who may develop adverse events three or four days post event. The development of a nurse led PPCI protocol (appendix A) has ensured PPCI patients are safely discharged in Bristol after 48 hours (Oriolo & Tagney, 2011) with the involvement of specialist nurse practitioners.

One Norwegian study identified a shorter hospital stay predicted higher depression levels at 18 months in MI patients (Hanssen, Nordrehaug, Eide, Bjelland, & Rokne, 2009).

**Table 5: Literature relating to length of hospital stay.**

| Author & Year | Study Title | Patient Group | Study Type | Assessment Tool | Size (*n*) | Findings |
|---|---|---|---|---|---|---|
| **Astin et al 2008a** | The information needs of patients treated with primary angioplasty for heart attack: An exploratory study | PPCI | Qualitative methodology | Interviews | 29 | Health information provision was satisfactory but improved by closer matching of patients' preferences with provision. Shortened hospital stay, rapid throughput and emotional shock influenced ability to absorb information making optimum timing for health information delivery variable. |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Astin et al 2008b** | Primary angioplasty for heart attack mismatch between expectations and reality | PPCI | Qualitative study | Illness Perception Questionnaire Interviews | 29 | Patients' experiences were characterized by a mismatch between their expectations and reality. Questionnaire data supported the notion that they had trouble in 'making sense' of their condition in a coherent way. They tended to see their condition as 'acute' rather than 'chronic' and their treatment as curative. |
| **Hansen et al, 2007** | How do early discharge after primary PCI impact on post-discharge mental stress and perception of health | PPCI | Prospective qualitative study | Interviews Likeart Scale (not specified) | 60 | 93% found hospital stay appropriate.<br>95% felt physically and mentally ready for discharge.<br>85% considered their condition not serious by day 2.<br>22% felt more 'sad' at 3 months.<br>87% considered their condition good at 3 months.<br>78% found the 3 day phone call useful. |
| **Hanssen et al, 2009** | Anxiety and depression after acute myocardial infarction: an 18 month follow-up study with repeated measures and comparison with a reference population | MI | Prospective cohort. | Hospital Anxiety and Depression Scale. | 288 | At baseline, AMI patients were more anxious, but not more depressed when compared with reference population. At 3–18 months, AMI patients' levels of anxiety and depression were no higher than levels in the reference population. Anxiety and depression at baseline and after 3 months were the best predictors of anxiety and depression after 18 months. Complications, bed days and lifestyle improvement significantly predicted depression after 18 months. |
| **Hosbond et al, 2007** | Do early discharge after primary PCI result in a higher rate of death or re-hospitalization? | PPCI | Prospective follow up | Non specified | 79 | Very low rate of death and rehospitalisation at 1 year. Safe to discharge patients within 4 days of PPCI post STEMI. |
| **Laarman & Dirkson, 2010** | Early discharge after primary percutaneous coronary intervention | PPCI | Literature review | None specified | None specified | The risk score reliably identifies a large group of patients at very low risk, who may safely be discharged early after primary angioplasty. This approach would also result in a substantial cost saving. |
| **Oriolo & Tagney, 2011** | PPCI: Is there a role for the ACS Advanced Nurse Practitioner? | ACS | Prospective Audit | Length of Stay | 274 | Patients seen and discharged solely by the advanced nurse practitioner the average LOS decreased from 4.4 days to 2.0 days. |

The speed of throughput can result in patients feeling they have not received enough information specific to their individual condition. Astin, Closs, McLenachan, Hunter, & Priestley, (2008b) interviewed 29 patients to evaluate their experience of post PPCI information. Patients general consensus was overall satisfaction. However, a common need was expressed for specific information relating to recurrence, myocardial

damage, activity, diet and medications. Astin et al (2008a) conclude the speed of throughput and shock experienced by patients can limit their ability to absorb information. They recommend staged information individualised to patient needs and home visits may improve patients experience and knowledge of their disease management.

Further research by Astin from the same group size revealed PPCI patients experiences to be positive although assessments demonstrated emotional shock exacerbated by their speedy treatment and discharge from hospital. The qualitative information collected from patients highlighted a mismatch between their experience and expectations. Patients did not fully understand their condition coherently and failed to view their CHD as a chronic condition, but rather felt it was an acute episode and they were now cured (Astin, Closs, McLenachan, Hunter, & Priestley, 2008b).

A small Danish study implemented a nurse led follow up programme for rapid discharge of PPCI patients (Hansen, Hosbond, & Thomsen, 2007). They followed up patients with phone calls, nurse led clinics and recommended a Cardiac Rehabilitation programme. The majority of feedback was positive. Patients felt their length of stay, being an average of 4 days or less was appropriate and felt positive about their condition. Of 60 patients, 22% felt 'sad' three months following their MI. The study mentioned 85% of patients considered their condition not serious at all by the second day post event. Although a positive response, one could question how complacent the patient feels about their condition. Hansen et al (2007) does not expand on this point.

The literature demonstrates the ongoing issues patients and healthcare professionals must negotiate when considering outcomes following the incidence and treatments for MI patients. The links between anxiety, depression, mortality and re-admissions can lead to increasing distress to the patient and prove costly to health services. The introduction of new treatments are shown to improve patient admission times,

therefore, more efficient use of hospital beds. However, the effect these treatments have on patient experiences should not be overlooked.

# 3. Methodology

## 3.1 Participants

This retrospective review involves patients admitted to the BRI from April 2004 up to March 2010. The selected patients were diagnosed with a STEMI and treated with either Thrombolysis or PPCI. Patient diagnosis is defined through assessment of symptoms and ECG. Thrombolysis, such as Tenectoplase or Reteplase, was administered as soon as the ECG confirmed an STEMI. Paramedics administered thrombolysis prior to patient transportation to the nearest accident and emergency department or coronary care unit. A blood test to identify elevated Troponin levels confirmed the extent of the diagnosis on arrival at hospital.

The BRI is a tertiary centre providing a twenty-four hour a day PPCI service for the wider area of the Southwest region for PPCI and rescue PCI. These areas include Bath, Cheltenham, Gloucester, North Bristol, Swindon and North Somerset. The introduction of PPCI involved patients going direct to the BRI the moment an STEMI was confirmed through ECG recordings, providing the procedure can be carried out within two hours from the onset of pain. Thrombolysis is not administered at any point.

Patient admission and treatment data was recorded in the Myocardial Infarction National Audit Project (MINAP) by the BRI cardiology department. MINAP data provided the initial source of patient selection for this study. MINAP Data shows 863 patients were treated for STEMI during April 2004 and March 2010. After their initial admission, patients were referred back to their own area for cardiology and cardiac rehabilitation follow-up. Cardiac rehabilitation is broken down into four phases at the BRI:

- Phase I - Initial event hospital admission.

- Phase II - Discharge home. Telephone contact. Pre-assessment clinic. Up to four weeks post initial event.
- Phase III- Comprehensive exercise programme consisting of 1 day per week for 8 weeks three weeks post initial event.
- Phase IV - Discharge to community and PCT.

For the purpose of this study, selected patients live in the South Bristol area to allow for consistency of data throughout their follow-up. Criteria for participants in the review also exclude patients with a previous history of MI, depression or known mental health issues. The remaining 283 participants were included regardless of their age or gender.

Dr Julian Strange (appendix B) and Dr Tom Johnson appendix C) of the Bristol Heart Institute offered support for this study. Alan Davies offered support in accessing data (appendix D)

Formal ethics approval was sought from South West 3 Research Ethics Committee but was not required as they considered the study to be a service evaluation. The University Of Chester Faculty Of Applied Sciences Research Ethics Committee approved this study application with Dr John Buckley acting as supervisor for this study (appendix E).

**3.2 Sourcing data**

Patient treatment and demographic information was determined from MINAP data. This accounted for the initial selection. After adjustment for exclusion criteria, the remaining 282 patients data was matched with Cardiac Rehabilitation PATS data (CRPATS). Readmission information was sourced from BRI patient records. Patient identification remained anonymous for the purpose of this study.

Comparison of MINAP and CRPATS determined referral to cardiac rehabilitation for phase I and uptake of the programme. MINAP data provided demographic information such as age, gender and current status.

Repeated measures were obtained for those who completed the cardiac rehabilitation pre and post programme questionnaire based on National Audit for Cardiac Rehabilitation (NACR) recommended guidelines. CRPATS data incorporates the (NACR) dataset along with specific information required for the BRI cardiac rehabilitation service. CRPATS provided information on cholesterol, hospital anxiety and depression scores (HADS) (appendix F), lifestyle and risk factors for those who were referred to the programme (appendix G). The use of HADS is recommended by the NACR and is a validated 4-point Likeart scale using 14 items. The 14 items are divided into categories: 7 anxiety and 7 depression. A score of $\geq$ 8 for either indicates presence of anxiety or depression respectively with a potential maximum score of 21 per category.

### 3.3 Statistical Analysis

To determine any significance between patient groups and re-admissions, the data was broken down to identify if re-admission was cardiac related or not. Cardiac related admissions included chest pain or breathlessness of unknown cause as well as further MI or angina related symptoms. Lifestyle, cholesterol and HADS were analysed for patients referred to the Cardiac Rehabilitation programme at phase I, attended phase II clinic and completed the phase III exercise programme. Risk factors are defined as activity, weight, BMI, smoking, alcohol, blood pressure and cholesterol. Risk factors were measured at phase 2 of cardiac rehabilitation, when patients attended the cardiac pre-assessment clinic, then again at phase three when patients completed the cardiac rehabilitation programme.

Statistical Package for the Social Sciences (SPSS) was applied for data analysis. Independent groups consisted of PPCI and Thrombolysis subjects. Parametric and non- Parametric data was determined by type of data, assumptions for normal distribution, using Kolmagorov-Smirnov statistic where the sample size is >100, Shapiro-Wilks for samples <100 and homogeneity of variance where appropriate. Parametric data was analysed using independent t-tests. Paired t-tests were applied to repeated measures. Non-parametric data was analysed using Chi Square, Mann Whitney U test for independent values, Wilcoxon test for repeated measures and Kruskal Wallis for multiple groups. HADS were recorded according to individual scores and level of risk i.e. Anxiety score of 1 to 7 = low level risk of anxiety, a score of 8 to 21 = moderate to high risk. Summary statistics of parametric data were expressed as means and standard deviations (SD) while those of non-parametric data sets are expressed as medians with ranges. Spearman's correlation was applied to investigate links between independent groups that did not assume equal distribution or homogeneity of variance or qualify for Pearsons correlation were non-parametric.

# 4:Analysis Results

MINAP provided initial data. Data included demographic information i.e. age, gender and financial year from when PPCI was first properly introduced at the BRI (table 6).

**Table 6: Demographic information**

| | | Thrombolysis | PPCI | Total |
|---|---|---|---|---|
| **Age** | ≤ 39 | 1 | 3 | 4 |
| | 40 - 49 | 15 | 20 | 35 |
| | 50 -59 | 21 | 49 | 70 |
| | 60 - 69 | 23 | 59 | 82 |
| | 70 - 79 | 25 | 37 | 62 |
| | ≥ 80 | 5 | 24 | 29 |
| **Total** | | | | 282 |
| **Gender** | Male | 67 | 139 | 207 |
| | Female | 22 | 53 | 75 |
| **Total** | | | | 282 |
| **Financial year** | 2004 / 2005 | 32 | 11 | 43 |
| | 2005 / 2006 | 21 | 8 | 29 |
| | 2006 / 2007 | 18 | 22 | 40 |
| | 2007 / 2008 | 4 | 36 | 40 |
| | 2008 / 2009 | 13 | 55 | 68 |
| | 2009 / 2010 | 2 | 60 | 62 |
| **Total** | | | | 282 |

From this point, patient details were matched with Cardiac Rehabilitation PATS data and BRI hospital records.

## 4.1 Re-admission

General readmissions amounted to 138 (49%) patients, 99 (35%) patients were re-admitted with cardiac related issues (table 7).

**Table 7: Financial year of Primary Event * Re-Admission Crosstabulation**

| Financial year of Primary Event | | Re-Admission (%) | |
|---|---|---|---|
| | April 2004/05 | 32 | (74) |
| | April 2005/06 | 15 | (52) |
| | April 2006/07 | 22 | (55) |
| | April 2007/08 | 18 | (45) |
| | April 2008/09 | 32 | (47) |
| | April 2009/10 | 19 | (31) |
| **Total** | | 138 | |

A Chi Square test shows significant differences between financial years and readmissions (P = .000). The percentage of patients readmitted gets lower for each year of initiating event.

A Chi-square test revealed no significant difference in patient re-admissions between Thrombolysis and PPCI. In terms of time from initial event and re-admission, the data did not satisfy assumptions for parametric testing therefore Mann-Whitney U tests were applied. Results demonstrate a significant difference between Thrombolysis and PPCI patients in terms of length of time before initial cardiac related re-admission (Table 8).

Cardiac related re-admission time:

P = .049

Median figures for Thrombolysis = 280 days from initial event to cardiac related re-admission

Median figure for PPCI = 182 days from initial event to cardiac related re-admission.

**Table 8: Readmissions**

| **Re-Admission Data** | | **Thrombolysis n = 90 *(%)*** | **PPCI n=192 *(%)*** | **Total n = 282 *(%)*** | ***P* Value** |
|---|---|---|---|---|---|
| **Patients readmitted Chi-Square Sig.** | | 53 *(58)* P = .092 | 85 *(44)* P = .112 | 139 *(49)* | |
| **Days to first unplanned re-admission** | Median | 280 | 182 | | .034 |
| | Range | 2358 | 2311 | | |
| **Patients with Cardiac Readmissions** | | 44 *(49)* | 55*(29)* | 99 *(35)* | 1.0 |
| **Days to first unplanned Cardiac re-admission** | Median | 289 | 182 | | .049 |
| | Range | 2355 | 1674 | | |

A Kruskal-Wallis test showed no significance in financial year and days to unplanned cardiac related readmission between each treatment (P = .354).

Spearman's correlation analysis was conducted to identify any links with re-admissions and HAD scores or levels. Data did not achieve assumptions of equal distribution, thus, a non-parametric analysis was applied. Results showed a link between PPCI total number of cardiac related re-admissions and phase II depression scores (P = .024). Correlation co-efficient = .386 (low) = 15% of 28 PPCI patients re-admitted with cardiac related symptoms.

Frequency of total general and cardiac related readmissions did not satisfy assumptions for parametric tests. Therefore, a Mann Whitney U test was applied. The results show no significant differences between Thrombolysis and PPCI patients (table 9).

**Table 9: Mann Whitney U Frequency of admissions**

| | Thrombolysis n | | PPCI n | | P value |
|---|---|---|---|---|---|
| | Min | Max | Min | Max | |
| **Total Readmissions** | 1 | 18 | 1 | 12 | .422 |
| **Total Cardiac Related Readmissions** | 1 | 16 | 1 | 4 | .052 |

## 4.2 Mortality Rates

Data was examined to determine the rate of deaths between the two treatment groups. The data did not satisfy equal distribution or homogeneity of variance. A Mann Whitney U test was conducted using split groups data and comparing groups. No significant differences in number of deaths were found amongst each group or between grouping variables (table 10).

**Table 10: Mortality**

| Treatment | Alive or dead at end of study period | N | % | P value |
|---|---|---|---|---|
| **Thrombolysis** | **(n=90)** | 79 | 87 | |
| **Alive** | | 10 | 11 | 1.00 |
| **Dead** | | 89 (1 missing) | | |
| **Total** | | | | |
| **PPCI** | **(n=192)** | 149 | 78 | |
| **Alive** | | 22 | 12 | 1.00 |
| **Dead** | | 171 (21 missing) | | |
| **Total** | | | | |
| **Mann Whitney U grouping variable** | | 89 | | .705 |
| **Thrombolysis** | | 171 | | |
| **PPCI** | | | | |

A second test determined if there were differences between the time span of initial event and death. Again, data did not satisfy equal distribution, therefore, a Mann Whitney U test calculated the result (table 11).

**Table 11: Time from initial event to death**

| | Treatment | N | Median (days) | Range | P Value |
|---|---|---|---|---|---|
| **Length of time until death** | Thrombolysis | 10 | 1329 | 1663 | |
| | PPCI | 22 | 157 | 179 | .001 |
| | Total | 32 | | | |

There is a significant difference between length of time from initial event and death (P = .001). PPCI is seen to have a much shorter time span, median 157 days to death compared to 1329 days for Thrombolysis patients. A Kruskal Wallis test analysed the time span of deaths for each financial year. The result showed a significant difference P = .001. Mann Whitney U tests were run to identify the differences (table 12). A Bonferroni adjustment for type one error meant results < .008 were significant.

**Table 12: Significant results of time until death**

| Financial Year | Median (days) | Range (days) | P Value |
|---|---|---|---|
| **2004/05** | 1639 | 1663 | .007 |
| **2008/09** | 136 | 333 | |
| **2005/06** | 666 | 1241 | .007 |
| **2008/09** | 136 | 333 | |

## 4.3 Length of stay

Length of stay data analysis established significances between Thrombolysis and PPCI patients in this study. The data satisfied the assumptions for equal distribution and homogeneity of variance. An independent t-test showed a significant difference between the two (P = .005) (table 13). PPCI patients had shorter hospital admissions following their initial event.

**Table 13: Comparing length of stay**

| | Treatment | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|---|
| **Length of Stay** | **Thrombolysis** | 90 | 8.66 days | 8.070 | .005 |
| | **PPCI** | 192 | 5.98 days | 7.012 | |

## 4.4 Cardiac Rehabilitation referrals

A total of 232 STEMI patients were referred to cardiac rehabilitation, 50 patients were not referred. Nominal data was tested using the non-parametric test to determine differences in referrals between groups. Mann Whitney U test resulted in no significant difference between the two groups (table 14).

**Table 14: Cardiac Rehabilitation Intervention**

| CR Phase | Thrombolysis Referred n = 82*(%)* | PPCI Referred n= 184 *(%)* | P value |
|---|---|---|---|
| **Phase I: Seen on ward by CR nurse** | 41*(50)* | 101*(55)* | 1.0 |
| **Phase II: Attended pre-assessment clinic** | 45 *(55)* | 113 *(61)* | 1.0 |
| **Phase III: Started exercise programme** | 39 *(48)* | 94 *(51)* | 1.0 |
| **Phase IV: Completed 8 week exercise programme** | 21 *(26)* | 54 *(29)* | 1.0 |

## 4.5 Anxiety and depression

### 4.5.1 STEMI treatment and HADS

Percentage calculations demonstrate improvements in anxiety and depression levels from phase II Cardiac Rehabilitation through to the end of phase III (table 15).

**Table 15: Comparison of Percentage of HADS levels between STEMI patients**

| HADS level | Thrombolysis % n = 37 (53 missing) | PPCI % n = 84 (108 missing) | Total = n |
|---|---|---|---|
| | Phase II n= 37 (53 missing) | Phase II n= 84 (108 missing) | |
| **Phase II anxiety <8** | 51% | 68% | 76 |
| **Phase II anxiety ≥8** | 49% | 32% | 45 |
| **Phase II depression <8** | 81% | 79% | 96 |
| **Phase II depression ≥ 8** | 23% | 21% | 25 |
| | Phase III n= 21 (69 missing) | Phase III n= 54 (138 missing) | |
| **Phase III anxiety <8** | 57% | 81% | 56 |
| **Phase III anxiety ≥8** | 43% | 19% | 19 |
| **Phase III depression <8** | 95% | 85% | 66 |
| **Phase III depression ≥ 8** | 5% | 15% | 9 |

Comparison of STEMI patient numbers demonstrates the transition of HADS levels over the course of the Cardiac Rehabilitation programme (figure 1). The general trend is of a reduction in all HAD scores and levels.

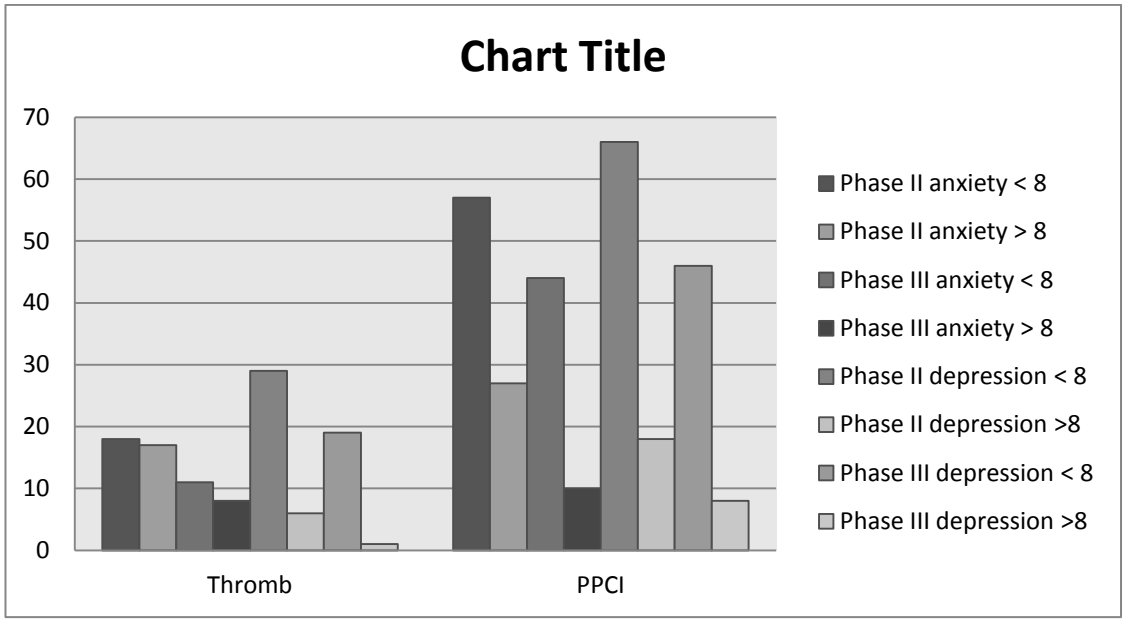


**Figure 1: Comparison of STEMI patient numbers and HADS levels**

HAD scores and levels were tested to identify differences between the groups at each stage of cardiac rehabilitation HAD Scores were tested for equal distribution and homogeneity of variance. Anxiety scores at phase II satisfied assumptions of

distribution and variance. A t-test showed no significant difference between Thrombolysis and PPCI anxiety scores at phase II (P = .272) (table 16).

**Table 16: HADS scores and levels independent variables**

| HADS | Phase II | | P value | Phase III | | P value |
|---|---|---|---|---|---|---|
| | Thrombolysis | PPCI | | Thrombolysis | PPCI | |
| **Anxiety Score** | Mean = 6.38 | Mean = 5.35 | .272 | Median = 4 | Median = 5 | .781 |
| **Depression Score** | Median = 4 | Median = 2 | .613 | Median = 2 | Median = 1.5 | .472 |
| **Anxiety level** | Median = 1 | Median = 1 | .085 | Median = 1 Range = 1 | Median = 1 Range = 1 | .031 |
| **Depression level** | Median = 1 | Median = 1 | .754 | Median = 1 | Median = 1 | .232 |

The remaining HAD scores did not meet the assumptions of distribution or variance.

HADS levels are deemed non-parametric as they were classed low or high. HAD Scores and levels were tested as independent groups using Mann Whitney U test. Results showed significance for phase III anxiety levels (P = .031) (table 16). Median and ranges all equal one. To clarify this result percentages between the two groups demonstrate the different outcomes at phase III (table 15):

Thrombolysis anxiety levels at phase III < 8 = 57%, $\geq$ 8 = 43%

PPCI anxiety levels at phase III <8 = 81%, $\geq$ 8 = 19%

Repeated HADS measures were analysed using the Wilcoxon analysis, as data is non-parametric (table 17). Thrombolysis repeated depression levels and scores resulted in a value of P = .037 demonstrating a significant reduction in scores and levels between phases.

**Table 17: Wilcoxon test of repeated HAD scores and levels**

| Treatment | | Anxiety Score at Phase 3 - Anxiety Score at Phase 2 | Post Anxiety level - Pre Anxiety level | Depression Score at Phase 3 - Depression Score at Phase 2 | Post Depression level - Pre Depression level |
|---|---|---|---|---|---|
| **Thrombolysis** | Asymp. Sig. (2-tailed) | .294 | .564 | .037 | .046 |
| **Median (range)** | | | | II = 4 (10)<br>III = 2 (8) | II = 1 (1)<br>III = 1 (1) |
| **PPCI** | Asymp. Sig. (2-tailed) | .260 | .480 | .223 | 1.000 |

## 4.5.2 Gender and HADS

A Mann-Whitney U analysis determined if gender differences existed between the two MI groups HADS scores. In terms of gender and HADS at phase II, no significant differences were identified (table 18).

**Table 18: Mann Whitney U test phase II HADS with Gender grouping variable**

| Treatment | | Anxiety at Phase II | Anxiety at Phase III | Depression at Phase II | Depression at Phase III |
|---|---|---|---|---|---|
| **Thrombolysis n = males 17 females 3** | P value | .261 | .136 | .249 | .327 |
| **PPCI n = males 40 females14** | P value | .257 | .019 | .648 | .496 |

However, phase III testing demonstrates a significant result between Anxiety scores and gender for PPCI the descriptive data shows:

Males = median 4 range 13

Females = median 7 range 12

The results signify higher levels of anxiety among PPCI females at phase III of cardiac rehabilitation.

### 4.5.3 Age and HADS

Age was divided into 6 groups. Each group represents ages at ten-year intervals i.e.

1 = <39

2 = 40 - 49

3 = 50 - 59

4 = 60 - 69

5 = 70 - 79

6 = >80

Age and HADS scores were compared for differences between PPCI and Thrombolysis. Phase II and III HAD scores and ages did not meet assumptions of equal distribution. A Kruskal-Wallis analysis was applied for the multiple groups (table 19). No significance was found between the groups.

**Table 19: Kruskal-Wallis test of age and HAD scores for STEMI patients**

| Treatment | | Anxiety at Phase II | Depression at Phase II | Anxiety at Phase III | Depression at Phase III |
|---|---|---|---|---|---|
| **Thrombolysis** | P value | .221 | .810 | .208 | .503 |
| **PPCI** | P value | .240 | .462 | .847 | .471 |

### 4.5.4 Length of Stay and HADS

Spearman's correlation analysed relationships between length of stay and HADS (table 20). Results revealed Thrombolysis anxiety scores and levels at correlate at phase III: P = .031 and P = .009 respectively. Depression levels correlate with length of stay for phase II thrombolysis patients P = .041.

**Table 20: Comparing PPCI and Thrombolysis correlation of length of stay (LOS) and HADS**

| HADS | LOS Thrombolysis | P value | LOS PPCI | P value |
|---|---|---|---|---|
| | Phase II | Phase III | Phase II | Phase III |
| **Anxiety score** | .411 | .031 Correlation co-efficient -.470 (modest) | .108 | .418 |
| **Anxiety level** | .461 | .009 Correlation co-efficient -.552 (modest) | .262 | .136 |
| **Depression Score** | .671 | .790 | .873 | .082 |
| **Depression level** | .041 Correlation co-efficient -.338 (low) | .255 | .754 | .845 |

Correlation co-efficient relates to the strength of the relationship (Cohen & Holliday, 1996). The strength of correlation is moderate for both anxiety measures. Depression level correlation is low.

Thrombolysis anxiety score at Phase III indicates a 22% co-efficient of determination with length of stay.

Thrombolysis anxiety level at phase III indicates a 30% co-efficient of determination with length of stay.

Thrombolysis depression level at phase II indicates an 11% co-efficient of determination.

In all three results, the correlation is negative indicating an increase in the significant HADS results to a decrease in length of stay.

## 4.6 Risk Factors

### 4.6.1 Risk factors between STEMI treatments

Paired testing was applied to investigate differences between Thrombolysis and PPCI repeated measures of risk factors for heart disease between phases II and III Cardiac Rehabilitation (table 21). None of the paired data satisfied equal distribution and homogeneity of variance therefore the non-parametric Wilcoxon test was applied.

Cholesterol and Smoking show improvements between phase II and III in both treatments. Activity has decreased in both treatments between phases. However, in all significant cases PPCI has shown better results in risk management. Furthermore, weight management and BMI only showed significant improvements in the PPCI group.

**Table 21: Compared repeated tests for risk factors between treatments**

| Risk factor(n) | Thrombolysis | | | | PPCI | | | |
|---|---|---|---|---|---|---|---|---|
| | Sample Size (n = 90) | P value | Phase II Median (range) | Phase III Median (range) | Sample Size (n = 192) | P value | Phase II Median (range) | Phase III Median (range) |
| **Cholesterol (mmol/l)** | 19 | .001 | 5.9 (3.4) | 3.8 (4) | 50 | .000 | 5.3 (7.8) | 4.3 (8) |
| **Systolic BP (mm/Hg)** | 25 | .054 | 125 (82) | 116 (64) | 69 | .644 | 120 (86) | 120 (75) |
| **Diastolic BP (mm/Hg)** | 24 | .875 | 75 (47) | 78 (37) | 66 | .886 | 72 (52) | 70 (50) |
| **Smoking** | 23 | .046 | 5 smoke | 1 smoke | 67 | .008 | 14 smoke | 7 smoke |
| **Weight (Kg)** | 19 | .266 | 76 (47) | 75 (46) | 50 | .002 | 80 (77) | 78 (86) |
| **BMI** | 17 | .109 | 25 (13) | 25 (11) | 48 | .001 | 26 (18) | 26 (20) |
| **Alcohol (units /week)** | 17 | .310 | 2 (35) | 4 (30) | 52 | 1.0 | 3 (30) | 4 (30) |
| ***Activity (hours /week)*** | *17* | *.006* | *2 (2)* | *1 (2)* | *59* | *.000* | *3 (2)* | *2 (2)* |

### 4.6.2 Risk Factors and Length of Stay:

A correlation test evaluated links between length of stay and risk factor management. The data did not satisfy equal distribution. A Spearman correlation test was applied (table 22).

**Table 22: Correlation of risk factors and length of stay**

| **Length of stay** | | |
|---|---|---|
| **Risk Factor** | **phase II P value** | **Phase III P value** |
| **cholesterol (mmol/l)** | .870 | .418 |
| **Systolic (mmol/Hg)** | 1.0 | .734 |
| **Diastolic (mmol/Hg)** | .012<br>Correlation Coefficient = -.187<br>Very low (3%) | .646 |
| **Smoking** | .506 | .521 |
| **Weight (Kg)** | .010<br>Correlation coefficient = -.168<br>Very low (2.8%) | .421 |
| **Alcohol (units / week)** | .033<br>Correlation coefficient = -.171<br>Very low (2.9%) | .834 |
| **Activity (hours / week)** | .301 | .983 |

Phase II correlations show a negative correlation in diastolic blood pressure, weight and alcohol. Indicating a decrease in the risk factors compared to an increase in length of stay at phase II. The correlations were low so not of great significance.

### 4.6.3 Age, Gender and risk factors

Investigation of age and gender determined if differences occurred in relation to risk factor management for BRI patients. The study consists of 206 men and 75 females (table 23).

**Table 23: Age at time of initial event * Gender Cross tabulation**

| | | Gender | | Total |
|---|---|---|---|---|
| | | Male | Female | |
| **Age at time of initial event** | < 39 | 3 | 1 | 4 |
| | 40 - 49 | 31 | 4 | 35 |
| | 50 - 59 | 58 | 12 | 70 |
| | 60 - 69 | 63 | 19 | 82 |
| | 70 - 79 | 42 | 19 | 61 |
| | >80 | 9 | 20 | 29 |
| **Total** | | 206 | 75 | 281 |

Neither gender nor age meet the assumptions for equal distribution and are therefore measured using non-parametric tests. The age group consists of 6 groups. A Kruskal-Wallis test identified if there were significant differences between age and risk factors (table 24).

**Table 24: Age related repeated risk factor measures**

| Risk factor for age | Phase II p value | Phase III p value |
|---|---|---|
| **Systolic Blood Pressure (mmHg)** | .889 | .662 |
| **Diastolic Blood Pressure (mmHg)** | .750 | .506 |
| **Cholesterol (mmol / l)** | .735 | .521 |
| **Smoking** | .003 | .680 |
| **Weight (Kg)** | .000 | .004 |
| **Alcohol (units / week)** | .001 | .229 |
| **Activity (hours / week)** | .043 | .580 |

Significant results included smoking, weight, alcohol and activity, were tested using Mann Whitney U tests. A Bonferroni adjustment prevents a type one error, due to multiple testing of each sample group: P = .05 / 6 = < .008 (table 25).

**Table 25: Mann Whitney U significant results of age and risk factors with Bonferroni adjustment**

| Risk Factor | Significant age groups 1 (n) | median (range) | Median Significant age group 2 (n) | Median (range) | P value |
|---|---|---|---|---|---|
| **Smoking phase II** | 40 - 49 (35) (23 still smoked) | 1 (1) | 70 - 79 (59) ( 18 still smoked) | 2 (1) | .001 |
| | | | ≥ 80 (28) (5 still smoked) | 2 (1) | .000 |
| **Weight Kg phase II** | 40 - 49 (29) | 85 (78) | ≥ 80 (22) | 64 (30) | .000 |
| | 50 - 59 (58) | 86 (75) | 60 - 69 (30) | 72 (64) | .000 |
| | | | 70 - 79 (52) | 76 (71) | .000 |
| | | | ≥ 80 (22) | 70 (60) | .000 |
| **Weight phase III** | 50 - 59 (13) | 85 (55) | 70 - 79 (18) | 70 (41) | .001 |
| **Alcohol phase II** | 50 - 59 (37) | 10 (42) | 60 - 69 (53) | 1 (40) | .000 |
| | | | 70 - 79 (38) | 1 (28) | .001 |
| **Activity phase II** | 50 - 59 (37) | 2 (2) | 60 - 69 (53) | 2 (2) | .000 |
| | | | 70 - 79 (38) | 3 (2) | .001 |

Results show fewer people smoked in the older age groups at point of their initiating event. Weight was lower in 60 to > 80 age group for both phases. Alcohol consumption was higher in the mid rang group of 50 - 59 and activity slightly lower.

A Wilcoxon test was applied to identify significant differences in gender and risk factors at each phase of Cardiac Rehabilitation. There are significant differences in all risk factors between gender and repeated tests (table 26). In phase III:

**Table 26: Wilcoxon test results for Gender and Risk factors**

| **Risk factor (Gender)** | **Phase II** | | | **Phase III** | | |
|---|---|---|---|---|---|---|
| | p value | Male median (range) *(n)* | Female median (range) *(n)* | p value | Male median (range) | Female median (range) |
| **Systolic Blood Pressure (mmHg)** | .000 | 120 (74) *(70)* | 123 (86) *(23)* | .000 | 120 (75) | 118 (74) |
| **Diastolic Blood Pressure (mmHg)** | .000 | 72 (54) *(69)* | 72 (45) *(20)* | .000 | 70 (45) | 76 (45) |
| **Cholesterol (mmol / l)** | .000 | 5.4 (5.4) *(52)* | 6 (6) *(16)* | .000 | 4 (5) | 4.7 (7) |
| **Smoking** | .000 | 2 (1) *(67)* | 2 (1) *(22)* | .000 | 2 (1) 4 smoke | 2 (1) 4 smoke |
| **Weight (Kg)** | .000 | 81 (77) *(54)* | 66 (43) *(14)* | .000 | 79 (86) | 67 (36) |
| **Alcohol (units / week)** | .000 | 3 (35) *(54)* | 2 (30) *(14)* | .000 | 4 (30) | 3 (14) |
| **Activity (hours / week)** | .000 | 3 (2) *(57)* | 3 (2) *(19)* | .000 | 1 (2) | 2 (2) |

Systolic blood pressure is unchanged in males and reduced in females. Diastolic blood pressure reduced for males, increased for females. Cholesterol has reduced for both at an almost equal rate. Ratio of smokers is less for males. Weight reduced for males and increased for females. Female weight is generally lower. Alcohol increased by 1 unit for both genders. Activity reduced for both but a greater decrease for males.

# 5: Discussion:

## 5.1 Unplanned readmissions

The percentage of patient unplanned readmissions was lower for PPCI over the course of the study. However, when running statistical tests the difference was insignificant in comparison to Thrombolysis patients. The lower percentage of PPCI patients could be interpreted as a promising trend towards fewer readmissions in the newer, more favoured PPCI treatment. In contrast, differences in percentage maybe explained by the point in time each patient entered the study. Thrombolysis was a commonplace treatment during the early years of the study, but became fewer as PPCI took over. In some cases, first readmission was up to six years after the initial event. Overall, figures show readmitted patients are fewer for those whose initiating event is most recent.

## 5.2 Frequency of unplanned readmissions

The significant differences in time before unplanned readmission support the aforementioned theory as both general and cardiac readmissions were over a shorter period for PPCI patients, P = .034 and P = .049 respectively. However, the number of readmissions remains insignificant per financial year. Furthermore, there was no significant difference found between financial years of initial events and the time before re-admission. Prospective study of PPCI patient outcomes may see the correlated difference even up over time.

Links between anxiety and depression in terms of readmissions revealed a correlation of P = .024 between PPCI total number of cardiac related re-admissions and phase II depression scores. The correlation co-efficient P = .386 is classed as low. The positive correlation implies higher PPCI patient depression score at phase II equates to more likely they will have multiple cardiac related unplanned readmissions. The relevant

correlation relates to 15% of 28 PPCI patients or 1 in 7 of cardiac related readmissions. Although the relationship may appear small, evidence has suggested even small increases in depression or anxiety can influence patient outcomes (Bush, et al 2001). Implications are for health professionals to be vigilant in assessing patients in the earlier stages following their event. Cardiac rehabilitation phase II HADS assessments at the BRI are often recorded as a baseline and reassessed at phase three, if the patients complete the programme. The authors experience has shown patients to be reluctant to act upon issues of anxiety and depression in the early weeks of recovery, but may seek GP advice if problems persist at phase III. More emphasis on educating patients and health professionals of the associated issues with CHD and depression could assist toward improving patient outcomes. Furthermore, better liaison between Cardiac Rehabilitation nurses and GPs, at all phases of the patient journey, may help to improve monitoring and early treatment of patients' emotional issues thus reducing readmissions and proving cost effective in the long term.

**5.3 Mortality rates**

Analysis of overall mortality rates concluded no significant difference between Thrombolysis and PPCI patients with a percentage of 11% and 12 %, respectively. However, time from initial event to death had a significant value of P = .001indicating significant differences. The PPCI group was found to have a shorter time span between initial event and death with a median of 157 days compared to 1329 for the Thrombolysis group. To clarify if the significance related to time of initiating event, analysis of financial years of initiating event and time until death was carried out and also revealed significant differences. However, following adjustments for multiple tests there was no significant differences between PPCI and Thrombolysis groups for each financial year. There were, however, significant differences between years for all STEMI patients. The year 2004/05 has a median of 1639 days before death, whereas

2008/09 is 136 days. PPCI patients were predominantly treated during the latter years of the review, therefore, as with results for unplanned readmissions, the time from initiating event and death is likely to alter prospectively. Even so, the statistic should not be ignored but be highlighted to ensure close monitoring of patient deaths continues with a view to examine and improve patient risks.

## 5.4 Length of hospital stay

A previous study identified PPCI patients to have a shorter length of hospital stay at the BRI (Oriolo & Tagney, 2011). The resulting evidence from this review confirms PPCI patients had shorter hospital admissions following their initial event (P = .005). Over the study period, PPCI patients stayed for an average of 6 days whereas Thrombolysis patients averaged 9 days. Oriolo and Tagney (2011) have reduced PPCI admission time in the last three years to average 2.7 days.

The correlation between length of stay and cardiac rehabilitation phase III anxiety scores (P = .031) and levels (P = .009) in thrombolysis patients showed a modest negative correlation co-efficient rating of P = -.470 and P = -.552 respectively. Results indicate an increase in anxiety at phase III in relation to a shorter length of stay in hospital. A low negative correlation for thrombolysis and depression at phase II (0.041) indicates increased levels of depression in the early weeks of recovery for patients with shorter hospital admissions. However, depression levels improved for patients completing cardiac rehabilitation phase III. The results imply patient anxiety and depression levels have improved with the introduction of PPCI despite shorter hospital admissions. One explanation for improvement is through developments within the cardiac rehabilitation service. Cardiac rehabilitation specialist nurses aim to visit all MI patients and advise them on disease and risk factor management prior to discharge. Information and literature is constantly being updated to ensure patients are clear about current issues related to their CHD diagnosis, treatments and recovery.

## 5.5 Uptake of cardiac rehabilitation

No significant differences for referrals to Cardiac Rehabilitation were found between the two groups. In fact, referrals and uptake of phase II and III remain consistent for both thrombolysis and PPCI patients. The results iimply no difference in complacency among PPCI patients compared Thrombolysis patients. The benefits of Cardiac Rehabilitation are undeniable in terms of all cause mortality (Jolliffe et al 2001) and readmission (Heran et al 2011). The NSF (2000) aim for 85% of all eligible patients being offered Cardiac Rehabilitation is met by the BRI team through ward contact and invite letters sent to patients on discharge. However, only 55 to 61% of the STEMI groups are responding to the invite and a maximum of 29 % are completing phase III. In terms of uptake and completion of the cardiac rehabilitation course at the BRI, vast improvements are necessary to increase patient interest.

## 5.6 Anxiety and depression levels between phases

Analysis demonstrates differences in anxiety levels between the STEMI groups. Significantly lower levels of anxiety are apparent in PPCI patients at phase III compared with Thrombolysis ($P = .031$).

Thrombolysis anxiety levels at phase III $< 8 = 57\%$ $> 8 = 43\%$

PPCI anxiety levels at phase III $<8 = 81\%$, $> 8 = 19\%$

Thrombolysis repeated depression levels and scores resulted in a value of $P = .037$ demonstrating a significant reduction in scores and levels between phases. These results are in agreement with length of hospital stay results.

The general trend for both groups is a reduction in anxiety and depression across both phases. However, PPCI patient depression levels do not reduce to the same extent as Thrombolysis patients at phase III:

PPCI depression score > 8 = 21% at phase II and 15% at phase III

Thrombolysis depression score > 8 = 23% at phase II and 5% at phase III

Evidence has demonstrated strong links with depression and mortality following an MI. The results, although not entirely significant in terms of analysis tests, may have some bearing on the significant results regarding PPCI length of time until death. However, the data in this study is limited and does not allow for analysis of phase III HADS scores and death rates due to most subjects completing phase III are recorded as still alive. Further investigation, through prospective study, is necessary to identify if there is a link.

Age had no bearing on HADS results but gender related analysis revealed female anxiety scores were higher than males at phase III (P = 0.019). A median of seven indicates scores to be bordering just below the level of concern but imply levels to be generally higher in females in accordance with Naqvi et al (2005) who noted depression levels are higher in women post MI. A low number of Thrombolysis female patient data made it difficult to assess phase III anxiety levels although the median = 9 for three females compared to median = 4 for 17 males.

## 5.7 Risk factors

### 5.7.1 Risk factors and length of hospital stay

When analysing the effect of length of hospital stay on risk factor management, results concluded a negative correlation in diastolic blood pressure, weight and alcohol at phase II. Indicating a decrease in the risk factor measurement compared to an increase in length of hospital stay and vice versa. Although the correlations were low and not considered of great significance, any threat to mortality or secondary event post MI should be seen as important and in need of further preventative intervention. Phase II assessment at the BRI occurs at approximately 2 to 4 weeks post initial event. One explanation for the negative correlation may relate to initial reaction to medication,

treatment, loss of appetite and desire for alcohol. Phase III sees no correlation, possibly because patients are more comfortable with their diagnosis and medications have been titrated to suit their blood pressure. A number of patients had stopped smoking thus possibly experiencing weight gain as a result. However, PPCI hospital admissions are much shorter, therefore, more emphasis is necessary on management of weight, alcohol intake and screening for blood pressure when educating patients at discharge and throughout their follow-up. This information should not be delivered by Cardiac Rehabilitation nurses alone, but involvement of GP's, cardiologists and other allied healthcare professionals would ensure consistent reinforcement of risk factor advice in post MI patient care.

### 5.7.2 Risk factors between phases

Cholesterol and Smoking have improved between phase II and III in both treatments indicating consistent compliance to medication, dietary and smoking advice. However, smoking remains a difficult issue. The smoking cessation service in Bristol is currently offering incentives to Health Authorities in order to increase referrals for patients who express a desire to stop smoking.

An area of concern is the decrease in activity for both treatments between phases. One explanation for this is patients interpretation of the activity questionnaire. Anecdotal reports, experienced by the author, indicate patients misinterpreting the questionnaire when completing it for phase II. Many patients report shopping, housework and going upstairs as exercise. On completing phase III cardiac rehabilitation exercise programme, it is possible patients have a better understanding of activities and exercise, thus report their activities more accurately. Another explanation relates to a number of patients who feel they have achieved their desired level of exercise and fail to complete the programme thus not submitting the 'post assessment' questionnaire.

Despite the issues mentioned, the significant risk factors results are more favourable in the PPCI patient group. Furthermore, weight management and BMI showed significant improvements in the PPCI group but not for Thrombolysis patients.

One can assume from these results that PPCI patients are not complacent about managing risk factors compared to Thrombolysis patients.

### 5.7.3 Risk factors and age

Results for risk factor and age analysis identified fewer people smoked in the older age groups (>70 years) at point of their initiating event. The 40 - 49 years group had a higher number of smokers at their initial event. Weight was significantly lower in 60 to > 80 age group for both phases. Alcohol consumption was higher in the mid rang group of 50 - 59 and activity slightly lower. All the significant results relate to co-morbid risk factors that are less prevalent issues in the older generations. This may be due to survival aspects of persistently poor management of risk factors meaning people die younger when they drink, smoke, are overweight or not very active. Results may also indicate a tendency for people to review their lifestyle as they get older in order to maintain a better quality of life.

### 5.7.4 Risk factors and gender

Significant differences resulted in all risk factors between gender and both phases of cardiac rehabilitation.

- Systolic blood pressure is unchanged in males with a significant drop in blood pressure range in females.
- Diastolic blood pressure range reduced for males, median figure increased for females.
- Cholesterol has reduced for both at an almost equal rate however, the females cholesterol range has increased.

- Ratio of smokers is less for males, only 4 smoked within both genders at phase III, however only 22 female data was recorded compared to 67 males.
- Weight reduced for males and increased for females. Female weight is generally lower.
- Alcohol increased by 1 unit for both genders.
- Activity reduced for both but a greater decrease for males.

The data demonstrates poorer outcomes in terms of risk factor management for women. Completion of the cardiac rehabilitation programme was generally lower for females included in the review: 29% males completed compared to 20% females.

Implications of the results between gender indicate motivating females to attend the cardiac rehabilitation programme and develop better methods to encourage improving and maintaining risk factors and lifestyle management in the long term.

# 6. Conclusion

The question raised at the beginning of this study involved identifying differences between Thrombolysis and PPCI patients short-term recovery from an STEMI in the South Bristol area. Reviewing patients progress through cardiac rehabilitation has answered many aspects of the initial question but also raised many more. One can assume from results, PPCI patients are not complacent about managing risk factors compared to Thrombolysis patients despite their HADS scores. However, length of stay does have a bearing on anxiety and depression as well as certain risk factors. Further investigation is necessary to establish if early depression levels link to early readmissions and premature deaths for PPCI patients.

Assessment of patients in the early days following their STEMI should account for length of stay and include greater emphasis on management of lifestyle, ensuring regular monitoring of CHD related risk factors continues after discharge. Allied health professionals may benefit from a greater understanding of the effects of anxiety and depression in the early weeks and long term following an MI and be encouraged to act upon elevated HADS at the earliest opportunity rather than monitor for signs of improvement. In turn, patient outcomes could benefit if encouraged to seek advice where anxiety or depression scores are elevated at any point during their recovery.

It is concerning that activity levels appear to decrease by the end of phase III Cardiac Rehabilitation. Further investigation would help to identify if the decrease is due to misinterpretation of the questionnaire or lack of motivation. An additional concern involves outcomes for female patients seeming to be poorer compared to males. More data is needed to identify if this a consistent problem. Many previous studies into CHD have expressed the lack of data related to females and their outcomes.

Improving communication between secondary and primary care at all phases of patients recovery, would ensure monitoring of patients remains regular and consistent as well as allowing opportunities for patients and health allied healthcare workers to express concerns about individual and general management of CHD patients.

Certain constraints resulted in limited data for analysis throughout this review. Constraints were mainly due to patients not referred to the Cardiac Rehabilitation Service, not accepting the invitation to phase II cardiac rehabilitation, not attending the exercise programme or not completing the exercise programme. The South Bristol Cardiac Rehabilitation team continue to strive toward increased uptake of the Cardiac Rehabilitation programme. Improved liaison with Cardiologists, GP's and CHD practice nurses may assist in influencing patients to attend and complete the Cardiac Rehabilitation programme, thus contributing to reducing all cause mortality and readmissions therefore proving cost effective to the health service.

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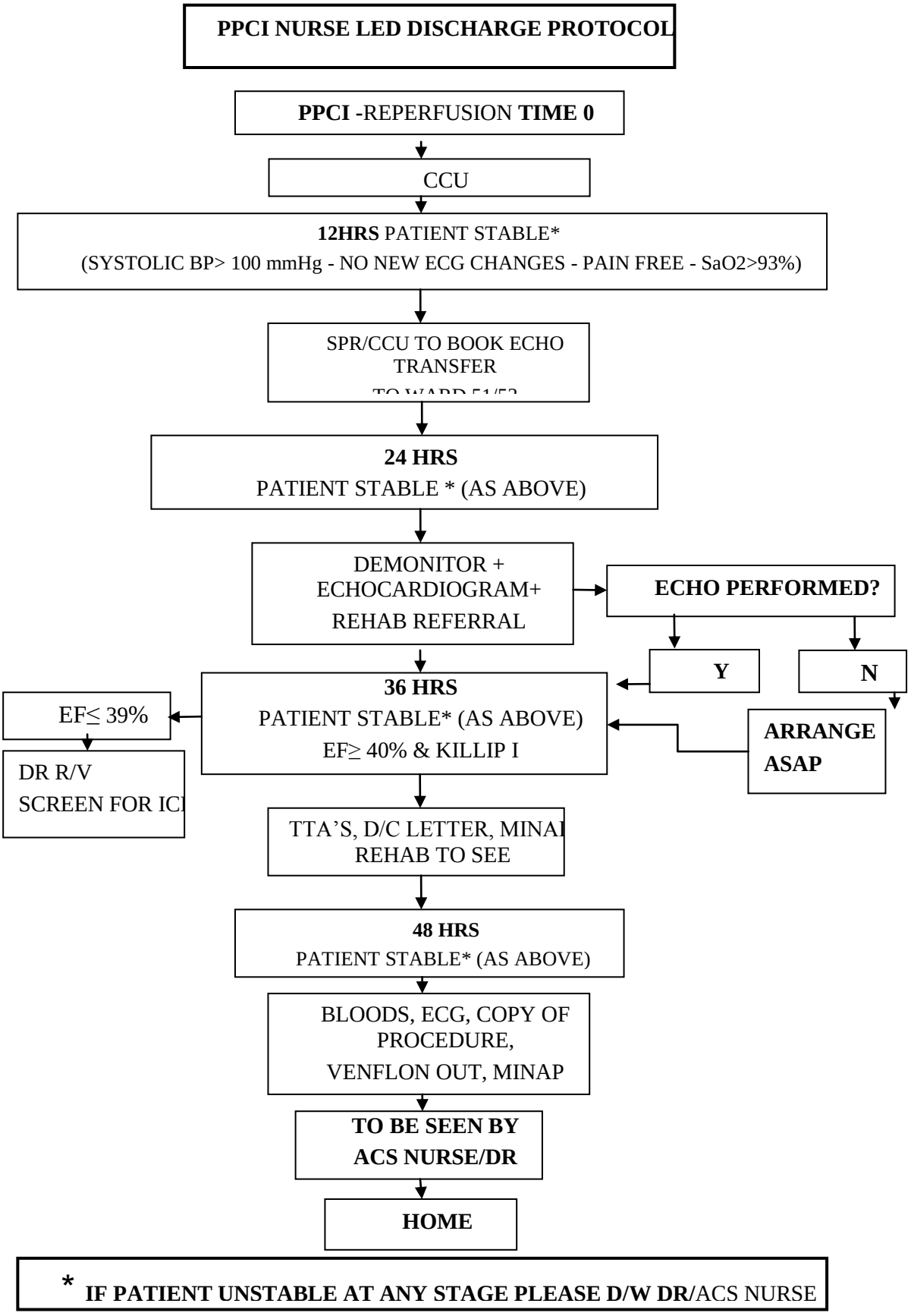
# 8. Appendix A: BRI Nurse Led Discharge Protocol for PPCI patients



# Appendix B: Letter from Dr Julian Strange

University Hospitals Bristol NHS
NHS Foundation Trust

Secretary's direct line:
Tel: 0117 342 6574
Fax: 0117 342 5968

Appointments direct line:
Tel: 0117 342 6504

Dr Julian W Strange MBChB MRCP MD
Consultant Cardiologist

Division of Specialised Services
Cardiology
Bristol Royal Infirmary
The Bristol Heart Institute
Marlborough Street
Bristol
BS2 8HW

JWS/JW

22nd October 2010

Fiona Barnard
Cardiac Rehabilitation Specialist Nurse
Level 7
BHI

Dear Fiona

Thank you very much for your letter regarding support for your future dissertation. I think it is an excellent idea to look into patients' psychological response to the differing treatments for acute myocardial infarction. Certainly it is an area that has not been fully explored and I hope will give us a very useful insight into this important outcome.

As the Cath lab Director and also network lead for acute coronary syndromes I give you full support and if I can facilitate your dissertation please do not hesitate to contact me.

Kind regards.

Yours sincerely,

Julian W Strange

POSITIVE ABOUT DISABLED PEOPLE

University Hospitals Bristol NHS Foundation Trust
Tel 0117 923 0000 Minicom 0117 94 9869 www.uhbristol.nhs.uk

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Working together
Our hospitals.

# Appendix C: Letter from Dr Tom Johnson

**University Hospitals Bristol** NHS
NHS Foundation Trust

Division of Specialised Services
***Cardiology***
The **New** Bristol Heart Institute
Bristol Royal Infirmary
Bristol. BS2 8HW

Tel: 0117 342 6573
Fax: 0117 342 9568
Mary.Scott@UHBristol.nhs.uk
**Out-patients Appointments:** 0117 342 6504

2nd November 2010

Dear Fiona,

I would be delighted to support you in the completion of your study assessing the variance in anxiety levels and unplanned readmission rates between patients treated for acute ST elevation myocardial infarction with primary percutaneous coronary intervention versus thrombolysis.

I look forward to my ongoing involvement with your studies for a Masters in Cardiovascular Rehabilitation.

Kind regards,

Dr Tom Johnson
Consultant Cardiologist

# Appendix D: Letter from Alan Davies

University Hospitals Bristol NHS
NHS Foundation Trust

**Clinical data office**
Bristol Heart Institute
Bristol Royal Infirmary
Bristol

BS2 8HW

Tel 0117 342 6589

Email: alan.davies@UHBristol.nhs.uk
website: www.uhbristol.nhs.uk

Dear Fiona,

Further to your letter and enclosed summary of your dissertation proposal concerning anxiety levels and unplanned readmissions in patients post PPCI compared to thrombolysis in post ST elevation myocardial infarction.

I can confirm the Bristol Heart Institute can support your application and allow access to the data sets required subject to ethics approval as outlined in your proposal.

Yours sincerely

Alan Davies

Clin cal data manager
Bristol Heart Institute

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Recognising Success
Working Together
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# Appendix E: Ethics approval FREC

University of Chester

*Faculty of Applied Sciences*
*Research Ethics Committee*

Tel 01244 511740
Fax 01244 511302
frec@chester.ac.uk

15th April 2011

Dear Fiona,

| | |
|---|---|
| **Study title:** | **Retrospective Analysis of Anxiety Levels and Unplanned Readmission in Patients treated Post ST Elevation Myocardial Infarction (STEMI) with Primary Percutaneous Cardiac Intervention (PPCI) Compared with Thrombolysis from April 2003 to March 2010.** |
| **FREC reference:** | **489/11/FB/CS** |
| **Version number:** | **1** |

Thank you for sending your application to the Faculty of Applied Sciences Research Ethics Committee for review.

I am pleased to confirm ethical approval for the above research, provided that you comply with the conditions set out in the attached document, and adhere to the processes described in your application form and supporting documentation.

The final list of documents reviewed and approved by the Committee is as follows:

| Document | Versi | Date |
|---|---|---|
| Application Form | 1 | November 2010 |
| Appendix 1 – List of References | 1 | November 2010 |
| Appendix 2 – C.V. for Lead Researcher | 1 | November 2010 |
| Appendix 3 – Letters of Confirmation | 1 | November 2010 |
| Appendix 4 – Personal Information Leaflet<br>United Bristol Healthcare – Patient Information Service | 1 | November 2010 |
| Appendix 5 – University Hospitals Bristol<br>Cardiac Rehabilitation Pre-assessment Clinic Questionnai | 1 | November 2010 |
| Response to FREC request for further information<br>and clarification | | April 2011 |
| Appendix 1 – Correspondence for Ethics approval from th<br>Sub-committee of the SW3REC. | 1 | April 2011 |

With the Committee's best wishes for the success of this project.

Yours sincerely,

---

**Simon Alford**
Chair, Faculty Research Ethics Committee

*Enclosures* *Standard conditions of approval.*

c.c. Supervisor
FREC Representative

# Appendix F: Had score

Doctors are aware that emotions play an important part in most illnesses. If your doctor knows about these feelings he will be able to help you more.
This questionnaire is designed to help your doctor to know how you feel. Read each item and place a firm tick in the box opposite the reply, which comes closest to how you have been feeling in the past week.
Don't take too long over your replies: your immediate reaction to each item will probably be more accurate than a long thought-out response.
*Tick only one box in each section*

**I feel tense or 'wound up':**
Most of the time .....
A lot of the time .....
Time to time, Occasionally .....
Not at all.....

**I feel as if I am slowed down:**
Nearly all the time .....
Very often.....
Sometimes .....
Not at all .....

**I still enjoy the things I used to enjoy:**
Definitely as much .....
Not quite so much .....
Only a little.....
Hardly at all.....

**I get a sort of frightened feeling like 'butterflies' in the stomach:**
Not at all .....
Occasionally .....
Quite often.....
Very often.....

**I get a sort of frightened feeling as if something awful is about to happen:**
Very definitely and quite badly .....
Yes, but not too badly .....
A little, but it doesn't worry me .....
Not at all.....

**I have lost interest in my appearance:**
Definitely.....
I don't take so much care as I should ..
I may not take quite as much care .....
I take just as much care as ever .....

**I can laugh and see the funny side of things:**
As much as I always could.....
Not quite so much now .....
Definitely not so much now .....
Not at all.....

**I feel restless as if I have to be on the move:**
Very much indeed.....
Quite a lot .....
Not very much .....
Not at all .....

**Worrying thoughts go through my mind:**
A great deal of the time .....
A lot of the time .....
From time to time but not too often ....
Only occasionally.....

**I look forward with enjoyment to things:**
As much as I ever did .....
Rather less than I used to.....
Definitely less than I used to .....
Hardly at all .....

**I feel cheerful:**
Not at all.....
Not often .....
Sometimes.....
Most of the time .....

**I get sudden feelings of panic:**
Very often indeed .....
Quite often.....
Not very often.....
Not at all .....

**I can sit at ease and feel relaxed:**
Definitely .....
Usually .....
Not often .....
Not at all.....

**I can enjoy a good book or radio or TV programme:**
Often.....
Sometimes .....
Not often.....
Very seldom .....

## Hospital Anxiety Depression – Scale Results Sheet

| A | D |
|---|---|
| 3 | |

| A | D |
|---|---|
| | 3 |

| | |
|---|---|
| 2 | [redacted] |
| 1 | |
| 0 | |

| | |
|---|---|
| [redacted] | 2 |
| | 1 |
| | 0 |

| A | D |
|---|---|
| [redacted] | 0 |
| | 1 |
| | 2 |
| | 3 |

| A | D |
|---|---|
| 0 | [redacted] |
| 1 | |
| 2 | |
| 3 | |

| A | D |
|---|---|
| 3 | [redacted] |
| 2 | |
| 1 | |
| 0 | |

| A | D |
|---|---|
| [redacted] | 3 |
| | 2 |
| | 1 |
| | 0 |

| A | D |
|---|---|
| [redacted] | 0 |
| | 1 |
| | 2 |
| | 3 |

| A | D |
|---|---|
| 3 | [redacted] |
| 2 | |
| 1 | |
| 0 | |

| A | D |
|---|---|
| 3 | [redacted] |
| 2 | |
| 1 | |
| 0 | |

| A | D |
|---|---|
| [redacted] | 0 |
| | 1 |
| | 2 |
| | 3 |

| A | D |
|---|---|
| [redacted] | 3 |
| | 2 |
| | 1 |
| | 0 |

| A | D |
|---|---|
| 3 | [redacted] |
| 2 | |
| 1 | |
| 0 | |

| A | D |
|---|---|
| 0 | [redacted] |
| 1 | |
| 2 | |
| 3 | |

| A | D |
|---|---|
| [redacted] | 0 |
| | 1 |
| | 2 |
| | 3 |

**FOR HOSPITAL USE ONLY**

SCORE A = …….

D = …….

# Appendix G: Risk Factor Questionnaire

**Smoking**

**• How would you describe your smoking habit?**

**Never smoked.....□**

**Not smoked for over one year.....□**

**Not smoked for over one month.....□**

**Not smoked for over one week.....□**

**Still smoking.....□**

**• If you are still smoking, do you want to stop?.....Yes □ No □**

**• Would you like more help with stopping?.....Yes □ No □**

**Diet**

**• Do you believe your diet to be healthy?.....Yes □ No □**

**• Would you like further advice about diet?.....Yes □ No □**

**• How much alcohol do you drink per week?.....**

**Physical Activity**

**1. Considering a 7-day period (a week), how many times on average do you do the following kinds of exercise for more than 15 minutes?**

**a. Strenuous Activity (heart beats rapidly/tiring)?**

**(e.g. running, jogging, vigorous long distance cycling, circuit training, aerobic dance, skipping, football, squash, basketball, roller skating, vigorous swimming)**

**b. Moderate Activity (not exhausting)?**

**(e.g. fast walking, mowing the lawn, tennis, easy cycling, badminton, easy swimming, ballroom dancing, fast or high step ups)**

**c. Mild Activity (minimal effort)? □**

**(e.g. easy walking, slow dancing, standing active fishing, bowling, golf, low step-ups)**

**2. Considering a 7-day period (a week), how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?**

**A Often**

**B Sometimes**

**C Never/Rarely**

**3. Do you take regular physical activity of at least 30 minutes duration on average 5 times a week?**

**A Yes**

**B No**

**4. What type of activity do you enjoy?**

**5. What are your goals?**